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INV. '60

# The Farmer's Digest

From more than two hundred magazines and bulletins published in this country and abroad, the Editorial Staff of the Farmer's Digest selects articles of outstanding merit and general interest. It is comprehensive in its scope, covering all phases of Agriculture.

**The Farmer's Digest**

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# The Farmer's Digest

Vol. 1 December, 1937 No. 8


## Crop Reports Are Hot News

**Condensed from The Nation's Agriculture**


***Joseph A. Becker***

**Chairman, Crop Reporting Board**


AT about three minutes to 3 p.m. on either the 9th or 10th of each month from April to November a group of newspaper reporters, telegraph operators, messengers and other persons concerned about the nation's crop prospects gather in the release room of the Bureau of Agricultural Economics in the South Building of the Department of Agriculture in Washington. From the crop reporting division just around the corner of the corridor, the Chairman of the Board appears with an armful of crop reports for release at 3 p.m. Exactly at 3 o'clock the Department Release Official gives the signal and those who are waiting receive a copy of the report and begin sending a digest of it all over the world by telephone, telegraph and other means of communication. Those who are interested then learn that the corn crop has been estimated at 1,509,000,000 bushels, the potato crop is 311,000,000 bushels, and so on down the long list of crops which the crop reports cover.

On certain occasions the releasing of the report is quite dramatic and a large group awaits it. For example, on August 1, 1936, it was generally known that drought had caused intensive damage to the nation's corn crop. There was great interest in how much damage would be indicated by the Board's report. Back of this dramatic release, however, there was a story of faithful co-operation on the part of thousands of farmers, and of hard work and careful timing of the various processes of compiling the estimates by the Department's staff.

Six months in advance the schedule of inquiry had been drafted and sent to the public printer. On the 15th of July the staffs of the forty field offices of


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the Crop Reporting Service began addressing envelopes and enclosing these schedules in them for distribution to the crop reporters. Rural mail carriers placed these envelopes in the farmers' hands about the 28th of the month. Between that date and the 1st of August each farmer mulled over the proper answer to the questions on the condition of corn and other crops in his locality. As the end of July came, he probably sat at the kitchen table, stub pencil in hand, and recorded his judgment of the crop situation in his vicinity. On the following day the mail carrier started the information towards Washington by way of the field office. In the state field offices the returns from all of the farmers of each state were gathered together, checked, compiled and averaged, and a composite figure for the state obtained.

After a review of the comments made by the crop reporters concerning the condition of the various crops, the statisticians in each field office made a composite descriptive report of what had happened to crops during the month and mailed this report in a special envelope to the Secretary of Agriculture.

The postal authorities at the Washington City Post Office recognize these special envelopes and send them directly to a vault at the office of the Secretary of Agriculture, where they are placed in a special mailbox that has two locks, the key to one of which is in the possession of the Crop Reporting Board and the other is in the custody of the Secretary of Agriculture.

Early on the morning of Crop Report day, members of the Board, accompanied by a guard, secure the envelopes from the Secretary's office and retire to the Crop Reporting Division to consider the reports from the various states. A complete section of the building is cut off from communication with the outside, by disconnecting telephones, drawing window shades, and placing guards at the doors. Then the condition figures and other information are studied in comparison with the condition and yields in former years, and the Board decides what yield per acre is indicated for a specified date by the reports. When the computations are completed and approved by the Secretary, the results are mimeographed and the report is ready for release.

The crop reporting work of the United States is one of the oldest functions of the Department of Agriculture. Strictly speaking, it antedates the formation of the Department. In 1839, when Martin Van Buren was President, Congress appropriated $1,000 to the Patent Office for the distribution of seeds and the

collection of agricultural statistics. For a number of years, of course, the service was quite limited in scope, but when the Department was formed in 1862, one of the going activities—the Crop Reporting Service—became a part of the Department.

At the present time the Crop Reporting Service represents an outstanding accomplishment in the field of co-operation among farmers. The bulwark of the organization is composed of the 80,000 regular crop reporters of the Department. There are one or more reporters in every agricultural county in the United States. These farmers give their time voluntarily at least once a month and frequently more often to recording their judgment of crop progress, condition, etc. There are special dairy reporters, price reporters, commercial truck crop reporters, livestock reporters, fruit reporters and miscellaneous reporters for such commodities as broomcorn, hops, cranberries, and rice. In addition, the rural mail carriers, three times a year, make a personal distribution of acreage and livestock cards. All in all, some 300,000 farmers participate in the crop reporting activities of the Department.

No current report of the prospective production would be of value unless it had for comparative purposes an accurate historical series. Therefore, the basic function of the Crop Reporting Service is computing, estimating and recording final figures showing annual agricultural production. In keeping books on agricultural production, the Crop Reporting Board utilizes any and all data upon which it can lay hands. Over a period of years an historical record of acreage and production of corn has been compiled and closely scrutinized from every angle in comparison with check data, such as the census reports, shipment records, assessors' compilations, and more thousands of reports from faithful crop reporters.

Since 1920, the results of the census taken each five years by the Bureau of the Census of the Department of Commerce give at each such five-year interval a cross section of agricultural development. Carlot shipment records and tonnage data from the railroads and such data as are available on truck shipments are also considered. The Board uses the reports of receipts of livestock by stockyards and packing plants, and for some specialized commodities, such as rice, sugar cane, sugar beets and cranberries, an annual enumeration is made, securing returns from every known operator.

Altogether, the Crop Reporting Board makes reports at one time or another in the year on 79

crops and 13 items of livestock and livestock products. From country dealers it gathers quotations on prices paid to farmers for the various agricultural commodities. On the basis of crop reporters' reports on disposition of farm commodities it prepares estimates of the proportion of the various commodities which are sold from the farms. Used in conjunction with reports on prices, these estimates are the basis of the department's reports on farm income.

For current estimates of crop acreage, yield, condition, and stocks, the crop reporters' monthly reports are the main sources of information. The crop season for any year starts in October of the preceding year, at which time information on the planting of early vegetables in the southern states is collected. In December the first major crops are covered by the report on seedings of winter wheat and rye. The report on condition of wheat in December frequently gives a fairly accurate indication of what the prospective winter wheat production will be in the succeeding year. In March farmers report their intentions to plant. These reports are interpreted by the Crop Reporting Board in terms of probable plantings and probable acreage for harvest, and the publication of the intentions-to-plant report enables crop reporters as well as other farmers to readjust their plans, if it appears that certain crops will be overplanted or underplanted in the country as a whole.

Beginning with April 1, the monthly reports on indicated production begin to appear with the report on winter wheat and rye. As these successive reports are published each month, the farmer utilizes them to aid him in his marketing program. With an authentic report on probable production he is in a better position to make up his mind whether to sell as soon as possible after harvest, to hold his crop, or to market it gradually. Co-operative organizations handling commodities for farmers are able to arrive at a marketing policy which can be adjusted from month to month as crop prospects change.

Livestock producers utilize the reports on livestock production, pig crops, and lamb crops to appraise the current livestock situation in terms of a longer time program, adjusting the size of their herds and flocks on the basis of what appears to be the trend of livestock numbers and the production of livestock products. Information on the prospective supplies of feed, including not only feed grains and hay, but also commercial feeds, is available to give an indication of

what prospective prices of these are likely to be, and so afford an opportunity to adjust feeding practices and livestock numbers so that losses will be averted and a profitable feeding margin maintained.

The greatest value of the Government Crop Reports, however, is that they provide a fair and unbiased basis for the market prices of the farm products of the nation. This is a direct benefit to every consumer, as well as to every producer, regardless of whether or not they ever see the reports, or make individual use of them.

# A Five-year Plan for American Farmers

**Condensed from Nation's Business**

***Ken Kimbel***

THE northern and midwestern livestock farmer has never been particularly concerned about the activities of boll weevils. The cattle and hog producers have concentrated on eliminating grasshoppers and other insects of the prairie states that harm their feed crops, without fear that the boll weevil would ever invade their territory.

But the boll weevil has devious ways of working. Because the boll weevil destroyed his cash crop in certain areas the cotton grower was forced to turn elsewhere. He learned that crop rotation and diversified farming could be practiced just as efficiently in the cotton area as in the corn and dairy states. He discovered that a garden could be made to supply a large part of his family's food. Gradually he has been improving the quantity and quality of his hogs, milk cows and beef cattle.

Today, because the boll weevil made him turn to other crops, the southern farmer is making his bid for the privilege of supplying a greater part of this country's food supply.

The construction of new packing plants and milk processing factories in the South is visible evidence that the livestock population of Dixie is on the march.

The story of Colquitt County, Ga., near the Florida line, shows the seriousness with which southerners have taken up diversified farming and demonstrates how the South may improve its agricultural possibilities.

In Colquitt County agriculture

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has run way ahead of industry—and industry caused this phenomenon.

The boll weevil made many southern counties turn from cotton, but Colquitt County "went the whole hog."

When the boll weevil pronounced the financial death sentence on the South in 1917, business men of Moultrie, county seat of Colquitt County, got together and went to work. The bankers held the farmers' notes for the cost of their crops; the business men had extended credit for other farm purchases. If they repeated this process for another year—on cotton—the same thing could happen again.

The farmers had already heard diversification preached so long that the Moultrie men had to do better than that. They did! They built a meat packing plant in the center of a cotton field, not so much to process meat as to give the farmers a great monument—concrete evidence of a daily cash market for livestock.

Many considered it the height of folly. What good was a packing plant in a cotton field? You couldn't make hams out of cotton bolls.

With the packing plant they instituted the world famous Colquitt County Five-Year Plan—no kin to the Russian variety. The plan sounds simple now but was revolutionary at that time.

Said the bankers to the farmer:

We will lend you money for next year, but with this money you must agree to buy a cow, sow, and chickens and plant a one-acre vegetable garden.

Now the characteristic cotton farmer in Georgia planted cotton and nothing else. He had no eggs, he had no hens, no hogs for home meat, not a sign of a vegetable and no cow. He planted cotton and rolled in "wealth" or suffered from hunger, depending on the success of his crop and the price of cotton, and seldom did he roll in wealth. The daily cotton quotation is front-page news in southern newspapers.

The farmers didn't think much of the idea but they had to accept the cow, sow, and hen program if they wanted money, and they had to have money.

The bankers and business men did a good job.

They obtained motion pictures of diversified farming, and showed them in every school house and church in Colquitt County. They had five-minute speakers like the Liberty Loan drive.

Then, they sent inspectors to visit the farms and see that the borrower was living up to his signed contract for the Five-Year Plan.

Pretty soon they had to build a road through the cotton field to

the packing plant, because the hogs and cattle started coming in and then the courageous men who had built that packing house discovered something! It takes a lot of money to run a packing house, and the profit lies in big operations and in the by-products.

Again they showed their wisdom. They went to Chicago and talked to Swift & Company.

The idea of a packing plant in Georgia sounded funny to Swift, just as it would have to any of the other packers at that time.

But these Georgians were sincere and confident. The idea of the Colquitt County Five-Year Plan, which was already spreading to adjoining counties, greatly interested the Swift executives. Moultrie's delegation admitted that they didn't have so many hogs and cattle now, but promised positively that they would have plenty soon.

And, Swift & Company bought a packing house in Georgia.

That was 20 years ago. Now Armour has a plant not 25 miles from Moultrie, Cudahy has just built a plant in Albany, 48 miles north of Moultrie, and Wilson and Company has just bought a small plant at Columbus, Ga.

The Five-Year Plan, slow and difficult at first, but enforced by contract, soon began to gain momentum of its own accord.

Farmers in other sections cannot appreciate the daring of this plan; they cannot picture a "farm" with not a single vegetable, no chickens, no cow, no hogs; or picture a "farmer" in town buying salt pork, but that was the actual condition in Colquitt in those days.

Today, Colquitt County is said to be the most widely diversified farming county in the United States. Fields are green 12 months in the year and there is ample rainfall at all times, due to its location between the Gulf of Mexico and the Atlantic Ocean.

Today Colquitt County ranks low in cotton production among the counties of the state.

It raises hogs by the thousands, every variety of vegetable, tobacco in a big way, peanuts, pecans, and other cash crops.

In 1917, the farm income of Colquitt County's 3,000 farms was $500,000. Today it is $10,000,000.

Of course, this ten million isn't net income. It doesn't mean that every farmer in the county makes $60 a week in addition to having all his food right on the farm, because despite the fact that Colquitt has diversified, that crops are rotated, that winter cover crops are turned under, the depleted cotton acres of this section still require plenty of fertilizer and this is a big item, but it was also a big item when the

income was only a half million dollars.

Colquitt County would be even more prosperous if it were located on the outskirts of Chicago or New York, because the county produces such an overabundance that Moultrie consumers use but a small percentage.

Moultrie's population is 8,000 and it is the only city, and practically the only town, in the county.

While Moultrie has grown rapidly in these past 20 years, it is still far behind the progress made in the rest of the county.

The dream of a packing plant became a reality and industry was out of balance with agriculture.

The farmers took one look at the packing plant, demanded assurance that cash would be paid out daily for cattle or hogs, went home and got busy. In fact, they almost outdid the packing plant.

Today, after many enlargements, it has a capacity of 2,000 hogs and 500 cattle daily. In the summer it doesn't get that many. In the winter, it gets more than that.

The old slogan, "A cash market daily for cattle and hogs," was enforced, even though the supply far exceeded the daily capacity and buying more hogs than he can kill in one day costs any packer money. The hogs carried over must not only be fed but, at the same time, they lose weight. At nine or ten cents a pound, 7,000 hogs losing two pounds daily runs into figures.

The packing plant that started in such an unusual manner, later developed a most unusual product—Peanut Hams. Hogs in this section are turned into the peanut fields and practically raised on peanuts.

Their pork is soft, not hard like the corn-fed pork of the North and West. In the beginning, the trade shied at soft pork. Then it was discovered that this soft pork had a peanut flavor, that it was different and a delicacy.

They called it "Peanut Pork" and it has developed into a specialty product. Georgia Peanut Hams are gradually building a name for themselves over the country. It was at this packing plant in Georgia that Georgia Peanut Hams originated.

Moultrie, like all Georgia towns, has always had its cotton market. In recent years, it acquired two peanut shelling plants that do capacity business, and a tobacco market that pays out about $2,000,000 in the course of the tobacco season.

However, Moultrie still has a long way to go to catch up with its country cousins outside the city limits. During the five winter months when hogs are mar-

keted in a big way, the natives call Moultrie's main street "Squeal Avenue," because every five minutes a truck load of squealing hogs rumbles down the street on its way to the packing plant.

Travelers who know the South can see the effects of the Colquitt County plan the instant they enter the county. Many of the farm homes are actually painted! Those who have traveled the Deep South and marveled at the absence of paint on country dwellings will appreciate this.

The Negroes are well dressed —that is unusual in the South. Even the Negroes have good cars. On Saturday in Moultrie you see thousands of farmers and their families, Saturdaying in town. Their arms are loaded with bundles, new cars line the curb, and there is a general air of prosperity about the whole scene, thanks to the working of the Colquitt County Plan.

## A New System of Dairying

**Condensed from Capper's Farmer**

*M. N. Beeler*

WHAT'S the way out for the milk producer? He finds his business entangled in a maze of trends, the net effect of which is to increase his costs and lower the price for his product.

What is the remedy? Obviously one is reduced production costs. But can material savings be effected. Trimble Brothers, Crawford county, Illinois, seem to have developed a system of dairying which reduces costs and at the same time protects the soil beyond the farthest hopes of conservationists.

They operate 600 acres and milk 75 cows, all but one of which are of their own breeding. Their herd of purebred Jerseys totals 125 head all ages. Approximately one-sixth of their land grows corn. The rest is in pasture mixture, lespedeza and alfalfa. Salt is the only ingredient of the Jersey ration which they buy. Pasture supports the herd in summer and only silage and hay are fed in winter. Under such a system of feeding and management they are producing a profitable milk flow and fat yield.

In 1924 they had 47 cows

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which averaged 4,320 pounds of milk. Last year they checked the production of some increase out of those cows. Twenty-one daughters by a given bull produced 5,829 pounds of milk, containing 311 pounds of fat—in 316 days. All they had was pasture, corn silage and salt. Feed costs figured by the cow tester (and which would of course not be strictly applicable elsewhere) averaged $40.21 a head. Feed cost per pound of fat was 13 cents.

"It's the cheapest ration we know how to produce," said A.T. Trimble. "Now we could increase both milk and fat production by feeding a grain mixture summer and winter. But that would double our feed costs at least, and we couldn't double production. We couldn't make the extra fat or milk as profitably as we can make the production we get now.

"Admitting that we might add 100 pounds of fat to our herd average by feeding a grain concentrate, what would that profit us when we can maintain another cow on the feed we use for a cost equivalent to, or less in value than, the extra grain we would feed the first?

"Yes, there's the labor involved in keeping another cow. But sale of bulls meet all labor costs on this farm, not only those involved in keeping cows but those required in equipment maintenance, tillage, seeding and harvest.

"We sell up to 30 bulls a year but average about 25, and approximately the same number of heifers. The oldest bull we have on hand (June, 1937) was dropped in August, 1936. In the face of our ability to sell bulls and the fact that they pay our labor charges, our interest in producing them needs no further explanation.

"Heavy grain feeding will sacrifice a cow for a record. Thousands of breeders have done just that. But why burn her out with the extra feed when you can't make a profit from it? By our system we keep cows in production 10 or 15 years—some longer than that. And they produce not only milk but calves, both at a profit. Ask any dairyman how long his grain fed cow lasts.

"We have a permanent program. Consequently it is to our interest to keep each animal unit at profitable production just as long as possible. Hence we prefer to keep the extra cow on the cheaper ration because we get, first the extra calf and second more calves from each cow because she lives longer. Under our system we make more clear money than we could by pushing the cows to the limit with grain concentrates. We've tried both plans."

Trimble Brothers are record keepers. Every 30 days for 9 years the Illinois College of Agriculture sent an auditor to the Trimble farm to check their books. The college was in search of accurate farm production costs.

As summaries of those records became available from the college auditor, Trimble Brothers began to make changes in their system, not particularly at the suggestion of college specialists, but upon their own reasoning. That was before the farm management service of the college began dividing farm projects and crops into high, medium and low profit groups.

And dairy specialists are still shaking their heads doubtfully over the most radical change made—feeding no grain other than that in silage, altho Trimble Brothers have been at it 14 years.

The Trimbles gave up growing wheat, soybeans and oats as a result of that accounting. They likewise abandoned city delivery of milk. Their efforts now are directed toward the production of whole milk, breeding stock and approximately 125 hogs a year. Their cropping program, five-sixths of the land in grass and legumes all the time, is quite as radical in comparison with average farmer practice as anything else they have done. And they adopted it at a time when such a program was even more radical than now when public consciousness of soil conservation is awakening. Trimble Brothers turned more than half their land to grass at a time when farmers firmly believed they couldn't afford to pasture high priced land.

Expert opinion, and evidence collected purposely to support it, is all against what Trimble Brothers are doing to their cows. They admit their system is unorthodox. Anybody who considers adopting the Trimble system should first analyze his own situation. Here is the way Carleton Trimble summarized theirs:

"We have a fertility and livestock program that is continuous. Our legume, pasture, feed and livestock program carry themselves and the farm almost regardless of adversity. They are so organized. Then when we have excess production beyond farm needs, irrespective of price, we have easy times. When there is an excess to market and prices are good we are prosperous.

"And our surpluses are from crops which maintain our herd and establishment. No additional expense is required in production. They are lespedeza and alfalfa hay, lespedeza seed, clover seed and corn. When those surpluses materialize, we have money for extra expenditures. That is free income. Those are the years

when we buy automobiles, tractors, paint the buildings, build fence, take a trip.

When we don't need lespedeza for pasture, it becomes surplus hay or seed to sell."

Their program is organized to insure maintenance of the establishment in hard times, to afford safety, to effect stability under adversity. Trimble Brothers' operations can be most clearly described by the term "dairy farming," a type of production wherein keeping dairy cows is merely a part of the farming system, as opposed to "dairying" wherein all operations are subordinated to the major project. And the vast majority of milk producers, particularly in the Middle-West, would be, could be or should be classified as dairy farmers. To that group the Trimble system should appeal.

The first need of that group is a permanent, stable system of farming and of production. If, after considering his situation, a man should decide such a program would be desirable, Trimble Brothers suggest how he may effect it:

1—Determine to produce his own feed. That involves feeding nothing, except minerals, that isn't produced on the home farm.

2—Organize field operations so as to insure that feed production to the extent humanly possible.

3—Adopt a feeding schedule to fit the cow's mechanism and natural grazing habits. That will require feeding 4 or 5 times a day.

4—Select cows of good blood out of ancestors with performance records. Use registration papers and testing records only as a guide in selection.

5—Take expert advice only after trial.

And lest somebody mistake their recommendations as the assumption of "expertness," Trimble Brothers suggest they be adopted only after trial.

Altho their feeding plan seems on the face to be the embodiment of simplicity, it involves a system, first, of providing adequate pasturage thruout as long a period as growing weather will permit; and, second, duplicating grazing times as nearly as possible during winter.

"Grass is the natural food for a cow," said A. T. Trimble. "We had to learn her grazing habits in summer so we could do an intelligent job of winter feeding. So we watched the herd on pasture. Then we adopted a management program to fit that schedule."

Here's what they learned:

1—Cows on pasture will start grazing at daylight. The Trimbles begin milking at 5 o'clock.

2—Cows will resume grazing again at 9 o'clock and when they

have completed their fill will lie down for 3 hours.

3—That will throw their next grazing period between 1 and 2 o'clock. Evening milking is done between 3 and 6 o'clock.

Note that milking times are 10 and 14 hours apart. That is quite unorthodox but it fits the cows' grazing and digestion periods.

4—The herd will fill immediately after six, as they are returned from milking to pasture.

5—About 8 o'clock in the evening they may and frequently do eat again.

The winter management schedule follows the grazing habits as closely as possible.

1—First in early morning the cows get all the silage they will eat. Milking begins at 5 o'clock.

2—Alfalfa hay is fed between 7 and 8 o'clock. The cows are watered at 9 o'clock and if the weather is bad are returned to their stable immediately. Otherwise they are allowed to remain out 3 to 4 hours. That corresponds to the summer morning rumination period.

3—At 1 o'clock they get all the silage they will eat.

4—Hay, alfalfa or lespedeza, is fed at 4 o'clock and evening milking follows immediately. In good weather they are turned out 1½ to 2 hours.

5—At 7 o'clock in the evening they are returned to the barn for another feed of hay.

"We carried our cows thru the last 12 months by that schedule on less than $40 worth of feed apiece and that included a pasture charge of $1.50 a month," said A. T. Trimble. "Our system leads to such experiences as a feed or pasture cost, in May, for instance, of 7 cents a pound fat.

"After 14 years of experience with this system, we have concluded that feeding a grain mixture is just another way of making a cow suit the farmer's convenience. If the management is made to fit the cow's schedule, she needs no grain on pasture and none other than that in the silage during winter. If adapting our management and feeding schedule to the cow's habits may be called a concession, it may also be said that we do it for a purpose, and the sole purpose of profit. The cows work for us. Under such a program the dairyman builds a farm instead of a feed bunk."

The system requires good, dependable pasture. Fat costs 3½ times as much in February on harvested feed as in May on grass. The result is grazing from April 1 until freezing weather stops growth. Their pasture schedule consists of:

1—Bluegrass, 40 acres, beginning April 1. It is pastured heavily and silage feeding is continued. Cattle remain on this field

until all the grass is gone.

2—Timothy, redtop and Korean lespedeza mixed pasture, without silage, receives the herd as soon as bluegrass is gone. The two grasses are available first. As they are grazed off, lespedeza comes on. Timothy and redtop will hold until July 1.

3—During July, August and September, Korean will be available in the mixed pasture.

4—Fall pasture is provided by revival of the timothy under that same fence and by the bluegrass which was heavily grazed in spring.

"We have an abundance of mixed pasture and lespedeza so that in even unfavorable seasons too close grazing of any area will be unnecessary and so the cows will not want," said Carleton. "We've tried sweet clover, rye and various sowed temporary or rotation pastures, and have given them up in favor of this program which operates almost automatically, both in insuring pasture and in providing a surplus of seeds and roughage to sell in favorable years."

In their cropping system corn is grown on the land but once in 5 or 6 years. Alfalfa is allowed to stand until it must be turned under because of failing stand. It is followed by corn and then returned to seeding, either alfalfa, grass mixture or lespedeza.

# Dry, Comfortable Poultry Houses

**Condensed from American Poultry Journal**

*A. O. Braeger*

A poultryman once said that it was just like pouring water on the litter not to insulate and ventilate the poultry house properly. And he wasn't far wrong, because 9 times out of 10, cold, damp houses are caused by improper circulation, and little or no insulation. Flock owners can overcome this situation by using some type of insulation material, and installing a good ventilating system.

The idea of insulation, of protection against extreme temperatures, is nothing new. The Eskimos learned long ago that houses built of loosely packed snow gave good protection from the cold, and natives of the tropics found that leaves and grass furnished good protection from the heat. Early settlers built houses of sod and grass, or, if in a wooded area, built log houses and barns. Later, when the logs were

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sawed into lumber, sawdust, leaves or shavings were put between the inner and outer walls of the house, thereby "insulating" the building.

Insulation is important not only because it prevents extreme temperature fluctuations, but also because it is the key to proper ventilation. Without adequate insulation, it is practically impossible to ventilate the poultry house properly. Whenever the temperature inside a building differs from that outside, the warm air or heat tends to travel from the warmer side to the cooler. Thus, in winter, heat constantly passes through the walls, roofs, windows, and doors. The greater the temperature difference between the inside and outside, the faster the heat will escape. The only way to prevent this loss of heat is to use proper materials for insulating when building a new house or remodeling the old one. If this is done, the flock owner need not worry about sudden changes in temperature inside the house even though the outside temperature has dropped suddenly. Likewise, the house will be more comfortable during the hot summer weather. That is why the use of insulation material is not limited to any particular section of the country. In the southern states, insulation fulfills a useful purpose in preventing wide inside temperature variations corresponding to the day and night variations occurring in winter and spring, and will make a cooler house in summer weather.

Experiments carried on at the Nebraska Agricultural Experiment Station showed that insulation provides from 8 to 10 degrees additional temperature protection over that obtained from a single wall house. In near zero weather, the inside of a well insulated poultry house should be from 25 to 30 degrees warmer than outside temperatures, according to reports from that station.

Insulation board comes in large sheets and can be nailed directly to the studding and when used as a ceiling, can be nailed to the rafters. Oftentimes, the insulating material is nailed directly under the roof sheathing. By doing this, no dead air space is made as when the insulation is nailed directly to the rafters. A layer of tough water-proof and air-tight paper between the sheathing and the drop siding makes the house more leak-proof. Such paper can also be used between the sheathing and roofing paper.

No domestic bird or animal requires as much fresh air as does the hen. It is a fact that a hen requires almost three times the amount of air to breathe as a human being. Little wonder,

then, why a good ventilation system is needed in the poultry house. Hens throw off an excessive amount of moisture which must be eliminated from the house. If this is not done, moisture in cold weather will condense on the ceiling and drip down on the birds, subjecting them to colds. Hens produce more eggs in summer than in winter. This is explained through the fact that in winter, unless properly housed, the hen must use feed and energy to keep warm and comfortable which otherwise would be turned into eggs.

One method of keeping the house cool and comfortable during the summer, in addition to insulation, is by providing an opening at least 10 or 12 inches wide and extending the length of the house just under the eaves in the rear. This will provide a rapid movement of air. This opening should be closed during the winter, however.

Probably the simplest type of ventilation system for a shed roof type of house is to have fresh air intakes above the windows to allow the fresh air to enter the house, and a roof ventilator to allow the foul air to escape. Many poultrymen do not have special intakes installed, and use the windows for this purpose. Windows that can be tilted inward from the top allow the air to enter the house without causing a draft on the birds. The ventilator on the roof should extend at least 3 or 4 ft. above the highest point of the roof in order that there is plenty of air movement to remove the foul air coming out of the house, thus preventing back drafts. The intakes should be twice to three times the area of the outlets in order that enough fresh air is supplied.

The number of ventilators, size of flues, and the number of intakes, of course, is dependent upon the size of the house and the number of birds housed. Each bird requires about 40 cu. ft. of air, and in order to provide fresh air at all times, such air must be changed 5 to 7 times per hour. This means that 280 cu. ft. of air per hour per bird should pass through the building. A 20x20 ft. house, therefore, with an area of 400 sq. ft., and containing an average of 100 birds, requires that 28,000 cu. ft. of air (100 multiplied by 280 cu. ft., the amount required by each bird) should pass through it each hour to provide fresh air at all times for the birds.

When installing a commercial ventilation system, it is best to follow the manufacturer's directions as to size and number of flues, number of intakes and methods of regulation.

# The University of California Agricultural Experiment Station

*Prof. Stanley B. Freeborn, Ph.D.*

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THE Argonauts of California, with their hopes directed toward the admission of California into the Union, wrote into the California Constitution of 1849 the requirements that the State government to be formed should be especially charged with the establishment of a "university" and the promotion of experimental work in agriculture. No connection between these two enterprises was intimated, the founders probably having in mind the quasi-public experimental grounds of the various state agricultural societies that had begun to flourish in many of the eastern states. Voicing the apparent will of the dominant interests in California at the time—mining and agriculture, the Legislature of 1866 created "The Agricultural, Mining, and Mechanical Arts College" and provided for the purchase of a farm of not less than 160 acres. Its inception proceeded to the extent of purchasing a site and creating an organized board of trustees.

At this point the provisions of the Constitution of 1849 for the foundation of a "university" were invoked by those particularly interested in an institution of classical learning, and much to the disgust of the patrons of agriculture who were skeptical of the fate of agriculture in the bosom of a "culture" college, the Legislature of 1868 provided for the merger of their prospective "College of Agricultural, Mining and Mechanical Arts" of 1866 and its site at Berkeley, with the classical "College of California," already established at Oakland. This satisfied the provisions of the Constitution of 1849 and by making certain revisions, the newly-formed institution, named the University of California, conformed to the requirements of the Morrill Act of 1862 and became the land-grant College of California.

Chief among the land-grant college requirements, of course, was the formation of a College of Agriculture, so among the first buildings erected was South Hall, dedicated to agriculture and pledged to its occupancy by orn-

amental plaques of agricultural motifs; but the newly-engaged professor of agriculture was gently but emphatically informed that he could hope for no more than the basement floor, and actually succeeded in getting only half of that.

At this particular period the bulk of our farmers looked upon education in agriculture from its social and political aspects, rather than the scientific. Their powerful demand for agricultural education was motivated by a desire to dignify the profession of agriculture and raise its disciples to the social plane enjoyed by those trained in the law, medicine and the ministry. It was with mixed feelings therefore that the farming elements of California saw the traditional professor of agriculture replaced in 1875 by the scientist, Eugene Woldemar Hilgard. Reared on an Illinois farm but trained under Liebig in Germany, he had already made an enviable reputation in Mississippi and Michigan as geologist, botanist and chemist, before he was called to California.

In his first report he pointed the path that California has followed almost unerringly in both agricultural instruction and research to this day, when he said: "A knowledge of facts and principles, and not the achievement of manual dexterity, must be the leading object of a truly useful course of instruction in agriculture."

In the winter of 1874–75 Hilgard received a grant of $250 for the establishment of an agricultural laboratory and the conduct of field experiments. This he utilized immediately and his first experiment, a study of the effect of deep versus shallow plowing for wheat, was inaugurated and completed before his rival for priority in the establishment of the first land-grant college agricultural experiment station, Professor Atwater, of Connecticut, had even succeeded in obtaining his legislative authority.

So insistently did Hilgard plead for financial support of his agricultural experiments and so well did he succeed in demonstrating the values of his scientific approach that the next Legislature of 1877 appropriated $5,000, and the next one in 1879 raised it to $10,000.

At about this time an epoch-making decision was reached by a wise and farsighted Director of the Census for 1880, who enlisted Hilgard's aid in directing the cotton section for that census. He was instructed to do something valuable for the cotton industry and was promised "adequate funds for inquiry, investigation, laboratory work and whatever else he deemed necessary to get at the fundamental facts and principles connected with cotton

growing in the United States." Hilgard jumped at the opportunity and with a group of enthusiastic assistants, plunged into a thorough study of soil conditions, statistics of production, history and management problems of every cotton-producing state in the union, including California. The two-volume work, produced as a contribution from the University of California, was written and carefully edited by Hilgard personally. One portion, entitled "The Physical Features of California," is consulted to this day by those in search of a clear, lucid picture of physical California.

The publication of this work had several important results. The most immediate was the direction of attention to California and the establishment of its reputation for scholarly work in agricultural research. It established the possibility of linking the educational facilities of the land-grant colleges with basic research for the promotion of the agricultural industry, and in that way was exceedingly important and perhaps directly responsible for molding public and legislative opinion to the point of establishing, through the Hatch Act of 1887, agricultural experiment stations at all the land-grant colleges.

California embraces an area roughly the width of Illinois at its widest part and extending from Chicago to New Orleans. Agriculture is practiced in various forms from one end to the other at elevations ranging from below sea level to well above the 5,000 foot level; in sections that have frosts every month in the year, as well as those where temperatures hover around 100° F. for many months. Agriculture is practiced in the desert with an annual rainfall of less than an inch and in sections that receive over sixty inches, yearly. This climatic diversity, coupled with its size and the tendency from early times to produce specialty crops, imposes an almost overwhelming burden on any one centralized agency attempting to meet the demands and inquiries of its agricultural constituency for information, guidance and leadership.

Hilgard attempted to meet this problem by utilizing the federal funds made available by the Hatch Act in the establishment of "outlying culture stations," strategically located at Jackson, Amador County; Paso Robles, San Luis Obispo County; Tulare, Tulare County, in 1888; and at Pomona in Los Angeles County in 1890. Each of these stations consisted of about twenty acres and a few buildings in charge of local foremen, who were to verify for their own areas the validity of the pronouncements of the home experiment station at Berk-

eley and test varieties under local conditions. With adequate funds the projects had merit but their very establishment and cost of maintenance prohibited any significant results while the home station was, at the same time, being deprived of the much-needed funds thus diverted. Their abandonment, Paso Robles and Jackson in 1903, and Pomona and Tulare about 1906 closed the career of this brood of outlying stations.

The Legislature of 1905 appropriated nearly $400,000 that accrued to agricultural development and provided for two outlying stations that could be manned and financed adequately, one the Plant Disease Laboratory at Whittier; and the other, the Citrus Experiment Station at Riverside. These were the forerunners of the splendidly-equipped research and graduate laboratories now located at Riverside, which were provided for originally in 1913 and subsequently enlarged.

The first act of 1866 made provision for a college on a farm, but immediately after the University was formed, the farmers claimed they had a farm but not a college. Nearly forty years later when it had become very apparent that Berkeley was not a fitting site for farming operations and the plantings of early days failed to materialize, another generation of farmers claimed they had a college, and a good one, but no farm. Consequently, the Legislature of 1905 authorized the purchase of not less than 320 acres and its equipment for a University Farm. In 1906 the site was chosen of 779 acres at Davis in Yolo County.

At the present time the major portion of both instructional and research work in Animal Husbandry, Truck Crops, Agronomy, Pomology, Viticulture, Dairy Industry, Irrigation and Agricultural Engineering is located on the Davis campus.

In 1932, following authority granted two years before, instruction and research work was instituted on the Los Angeles campus in Subtropical Horticulture.

Thus, on four of the University of California's seven campuses the College of Agriculture is carrying on not only instructional work but the functions of the agricultural experiment station. In addition, minor stations ranging from half-acre plots in intensively-used commercial sections, to forest acreages running into the thousands, are utilized at various points in the State, for experimental purposes.

The early work of the California station was largely that of chemical import, the analyses of soils, water, feedstuffs, and wine, all with the cunning touch of

Hilgard, who could illuminate the darkest page of chemical statistics with the flame of philosophy until it became a veritable handbook of practical and thoughtful information. The first systematic soil survey was undertaken in 1880 with a collector equipped with a railroad handcar, who pumped himself up and down the interior valleys and foothills, dodging trains and collecting some 700 samples of soil which formed the basis for the first work on California soils that was incorporated in the census of 1880. Soils were Hilgard's first love and have always played an important role in the work of the California station. "Alkali" soil claimed his early attention and he did much to make plain the problem which continued to be of such serious significance that one of his successors, Dean Thomas F. Hunt, proclaimed it California's most important problem. The present generation of California's soil scientists, building on the work of their predecessors, have at last described a procedure of satisfactory reclamation by adhering, in the face of insistent demands that they spend their energies otherwise, to the wise counsel of Hilgard that they devote their time to "a knowledge of facts and principles."

Closely associated with problems of the soil are the problems of plant nutrition. At the California station these fields, thanks again to the influence of Hilgard, have always been closely associated. The station has played a leading role in the determination of the elements necessary for plant growth and has demonstrated the clinical pictures that their deficiency caused. Typical examples are the potash-binding soils which cause prune die-back and the zinc deficiency and its disease, "little leaf" or "mottle leaf," which have been demonstrated recently.

In 1891 the fields of entomology and plant diseases were covered by one man who was primarily an entomologist, but in 1902 the first experiment station plant pathologist in the United States was added to the staff and continues to turn out a prodigious amount of work. The two fields are still closely associated in the investigations of viruses and insect-borne plant diseases which have been particularly progressive at the California station. The story of their conquests would be a recitation of the plagues of insects and diseases that have ravaged California's specialized agriculture, under which epidemic invasions are particularly serious. Specializations such as biological control with headquarters at Riverside, where on several occasions importations of beneficial parasites have literally saved the

citrus industry, are particularly dramatic. Work with insects affecting man and domesticated animals has not been neglected. The first organized campaign for malaria control in the United States was undertaken by the Experiment Station at Penryn, California, in 1910, and since that time a series of fundamental discoveries has placed the California station in a prominent position in this field.

Animal Husbandry, handicapped by the fact that it was difficult to maintain livestock on the Berkeley campus, did not begin to function importantly until the inauguration of the University Farm. Work in this line was developed originally along orthodox lines, with emphasis on standard feeding trials and the production of prize animals. In 1926, however, the division was radically reorganized for a study of the basic facts of animal life, physiology, nutrition, genetics and their practical application to field problems. This recognition of the experiment station's function as applied to animal husbandry has already borne fruit in the form of forward-looking publications on the problems of range management from the standpoint of nutrition, the inheritance of growth factors and their isolation, the function of various endocrine secretions, heat exchange, and many other difficult problems of real importance to the industry, yet problems that the individual livestock man could not do for himself.

A few years ago, through the gift of Mr. A. P. Giannini, there was established in the College of Agriculture, and utilizing the existing Division of Agricultural Economics as a nucleus, the Giannini Foundation of Agricultural Economics. With this financial aid a group of economists cognizant of agriculture and its problems, have been assembled and provided with facilities for work on the basic problems of economic and social nature that agriculture faces today. The program of this group has been seriously curtailed by the inclusion of many short-time investigations of an emergency nature occasioned by the depression and the "action programs" of the federal government, but it is slowly emerging from its burden of "directed" research and assuming a position of leadership in economic thought as applied to agriculture.

If space were available for a chronicle of present-day achievements of the Station, an imposing array of accomplishments could be set forth that are profoundly affecting California's agriculture. In such a statement mention would be made of the story underlying the fact that two-thirds of the State's cereal crops are

grown from seed developed or introduced by the station; and that nearly the entire melon crop of the Imperial Valley is the progeny of disease-resistant strains developed at the station. We should mention the internationally-famous work in poultry nutrition; the fundamental work that is being carried on in the selection of proper varieties and climates for quality wine production; the epoch-making proof that costly dust mulches were worth no more as moisture conservers than the weeds they removed. And as a last moment news release, we would broadcast the perfection of a smudgeless smudge pot, whose radiant energy effectively protects against frost without the production of devastating palls of carbon particles.

Despite the fact that the California station is the largest single one in the union, its cost of operation is far from the top in terms of dollars spent per unit value of agricultural commodities produced. Its effectiveness and economy are based on its attack of fundamental principles.

Experiment Stations were conceived for the purpose of solving for the agricultural industry those problems which the farmers could not solve for themselves. The California station, in addition to maintaining this concept, has been particularly fortunate in being able to divest itself of the responsibilities of routine services and regulatory duties, the performance of which, although exceedingly important, rest better in departments of government than in institutions devoted to research and education. With these advantages and with its basic philosophy, that of testing each projected problem by determining if its solution would be (1) of general application (either practically or in the development of future research), and (2) an addition to basic knowledge, the output has been strikingly effective, remarkably economical and of wide application to the diversified agricultural constituency of California.

These were the principles of Hilgard, father of the experiment station development and patron saint of agricultural workers at the California station.

# Minerals in the Winter Dairy Ration

**Condensed from American Agriculturist**

*Prof. L. A. Maynard, Ph.D.*

**Professor of Animal Nutrition, Cornell University**

THE animal body must be supplied regularly with at least a dozen different minerals that are just as essential as protein. Fortunately, most of them are always supplied in abundance in dairy feeds and need no special consideration. Aside from salt, calcium and phosphorus and sometimes iodine are the only ones we need to think about in making up rations.

It is possible adequately to supply the calcium and phosphorus needs by a proper selection of the commonly-used feeds without the addition of a mineral supplement. In making this selection the following facts must be remembered. No grain mixture is rich in calcium in terms of the animal's needs. We must look to the roughage for this element. A ration which is based entirely on timothy cannot be relied upon to supply sufficient calcium, but there will always be plenty where legume hay is used. The situation is very different as regards phosphorus. Even the best legume roughage is not rich in this element. Cereal grains and their products contain somewhat more, but hay and these concentrates alone may not provide a sufficient amount. Phosphorus is liberally supplied, however, by such feeds as wheat bran, the oil meals and certain other high-protein feeds.

While the calf is receiving a generous amount of whole or skim milk there is no question about its receiving enough calcium and phosphorus. As the milk is cut down, at least a part of the hay which it receives should be legume to be sure of supplying calcium adequately. The grain mixture fed should contain at least 20 per cent of one of the high phosphorus feeds to provide this element. If the calf is fed liberally according to this procedure, there will be no need for any mineral supplement. Roughage that is green, leafy and sun-cured provides the vitamin which is needed to aid calcium and phosphorus assimilation. Give the calf the best roughage available on the farm. If it

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must be fed entirely on timothy hay and grain, a calcium supplement is certainly needed.

The same general principles apply to the dairy cow. In order to provide sufficient calcium, the hay should be at least one-half legume, and the grain mixture should contain some of the high-phosphorus feeds in liberal amounts. Where this kind of a ration is available and the grain mixture is being fed liberally, there should be no lack of these minerals. Special attention needs to be given a cow during the last part of her lactation period and while she is dry, when the intake of concentrates is normally reduced. While the milk production is low or nil at this time, it is the period when the cow is most actively storing calcium and phosphorus in the unborn calf. Unless the feeding of a grain mixture containing high-phosphorus feeds is continued, the ration will be low in this element. From the standpoint of calcium, also, it should be borne in mind that the cow should not be fed poor hay just because she is not giving much milk.

If it is not possible to make up rations in accordance with the above suggestions a mineral supplement should be provided. Bone meal supplies both calcium and phosphorus and thus will take care of any deficiency in either one. Its inclusion is cheap insurance that the mineral needs of the cow will always be met. It can be added to the grain mixture as 1 per cent or it can be self-fed, mixed with salt. During the dry period or at other times when little grain is being fed, self-feeding will make sure that the intake is adequate.

Additional iodine is needed in certain areas for the prevention of goiter or big neck in calves. Where these troubles are occurring the cow should receive iodized salt or some other form of this element during the gestation period. It is my belief that the feeding of additional iodine has no value except for the specific purpose of the prevention of goiter, and for this purpose its feeding can be limited to the gestation period. I do not think that the addition of iodine to our dairy rations here in the Northeast will have any benefit as regards growth, milk production or the prevention of disease. Nor do I feel that the inclusion of iron, magnesium or any of the several other elements which are sometimes present in complex mineral mixtures has any value.

# Tree Farm

**Condensed from The Nebraska Farmer**

*Tom Leadley*

THE biggest tree seedling nursery in the United States is at the headquarters of the Bessey and Niobrara National Forest Reserves near Halsey, Nebraska. There millions of seedling trees are grown and distributed each year, in addition to the steady expansion of the tree acreage within the national forest reserves.

Red cedar, Jack pines, Ponderosa pine, a few Scotch and Austrian pines and some mountain ash are the principal seedlings grown. The maximum capacity of the nursery is about 6 million trees. About 3 million seedlings of 2 and 3 years of age are distributed each year, mostly within the state. Nearly one-half million go to individual farmers at a cost of 1 cent each. Another million are obtained from private nurseries for this low cost farm distribution.

The others are used for shelterbelt plantings and for forest expansion in the Reserves. To date about 90 million trees have been distributed from the Halsey nursery since its establishment in 1902 under President Theodore Roosevelt's administration.

The Bessey and Niobrara reserves contain 206,000 acres; 96,000 acres in the Bessey (named after Dr. Charles E. Bessey, beloved and nationally known botanist of the University of Nebraska) and 110,000 acres in the Niobrara. In both forests to date 17,000 acres have been planted, the most of them (14,500 acres) in the Bessey forest.

The first plantings in 1903 were Jack and Ponderosa pine wildings from Minnesota and the Black Hills. These were set out on the slopes of the sandhills bordering the Middle Loup river. Despite the doubters who said trees wouldn't grow there, the seedlings thrived and grew, and as the years went by the drab hills around Halsey began to take on the dark green of a forest. Then came a forest fire, in 1910, when adequate fire-fighting equipment was not available in the forest, and wiped out the early plantings except for a few scattered Ponderosa pine.

Undiscouraged, the tree planters began anew, the nursery was expanded to provide more trees for the reserves as well as for farm distribution, and now each

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year records a continued expansion in the acreage and increased growth of the trees. The oldest of the present plantings, dating back to 1911, show a height of 30 to 40 feet. A forest lookout station has been built to spot immediately any fire outbreaks.

Aside from the extensive distribution of seedlings to farmers, which of course has been of immeasurable value, 800 acres of forest plantings have been thinned out and the cuttings used for posts, poles and fuel. A forest of commercial value is a long time in growing and the future will tell more definitely what to expect. Some additional revenue is obtained from leasing 5,000 acres of the forest for grazing purposes.

Every fall the Halsey station holds a field day to which people of the state are invited. More than 1,100 registered for this year's field day.

# These 4000 Lambs Went to Market — Fat

**Condensed from Breeder's Gazette**

*Irvin J. Mathews*

AMONG the most extensive lamb feeders east of the Mississippi are Joseph Wall and his son, Otis. On their 460-acre Boone Co., Ind., farm they have changed lamb-feeding from a haphazard procedure to an exact science. A key implement with the Walls is their roughage mill. Equipped with a grain separator, it chops the roughages, separates and grinds the grain in one operation.

Uncle Joe Wall is now in his 75th year, but has kept his mind young. He was the first man in that country to use a tractor, the first to grow soybeans. Each year he develops new economies, "We must grow just as much protein as we can right out of our own ground," he says. The Walls plant an extra row of soybeans between their corn rows after the corn has been cultivated the first time. They straddle the rows with the corn planter, and drill in 8 lbs. of Ito Sans to the acre. Removing the outside shovel from the cultivator gangs, they cultivate the corn the second time just before the beans come through the ground. Then they cultivate only once more, if at all. After that, there is shade enough to keep the weeds down.

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These mid-row soybeans are from 20 to 24 in. high and pretty well podded out. As nearly as they can judge, they get a ton of soybean pasture, extra, for each acre planted that way. About the middle of September, a few lambs are turned into the cornfield to graze the mid-rows of soybeans. As soon as the lambs nibble the corn, they are taken out. After all the shock fodder has been hauled to the barn, chopped and stored in the mow, fattening hogs are turned into the field to pick up the shattered soybeans.

On another field is practiced a most unusual oat-soybean, one-year rotation, giving two crops each year off the same land. Early Harvest oats are planted in March and, as soon as the bundles are cured, the sheaves are run through the roughage mill, grain and all, and stored in bins in the barn. Then the soil is disked and soybeans are sowed in late July. The soybean halm is shocked after the beans have been shelled out with the barnyard combine. The Walls are unable to store all their roughage in their barns, even though three times as much chopped bright roughage can be put up as the loose form. So they bring in the soybean shocks and run them through the mill during the winter.

Still another field showed two-crop farming. Here 500 yearling ewes were pasturing on 40 acres of early-sowed rye. This field had grown sweet clover the fore part of the year, and pastured 1,000 yearling sheep up to August 15th. As soon as the sweet clover folded up, the soil was thoroughly disked, and drilled to rye. Lapping up the nitrogen of the sweet clover, the rye came on with a bound and, even with 500 yearlings on it, had a thick mat of vegetation. But while on such lush pasture, the sheep had access to bunks full of roughage-grain ration, too.

"Never let a lamb stop gaining" Mr. Wall told me. "Don't let them lose that milk fat; it will take a lot of feed to get it back." His lambs go on full feed the minute they hit his farm. He said further, "Our methods enable us to feed the entire year, never letting our equipment stand idle. Last year we fed out 4,700 lambs and yearlings; this year we will feed that many or more, and most of the roughage and grain for these lambs grew right out of the ground on this 460 acres of land. With our mill, we turn into mutton what otherwise went back to Mother Nature. Two-fifths the feeding value of corn is in the stalk. If that can be made usable to the lambs, we not only increase our available feeds off the same land by two-fifths, but we cut down the over-

head of producing the corn grain by just that much.

"Our first principle is never to feed any grain alone, but with uniformly chopped roughage, free from dust. Ground grain, mixed with roughage, means that each particle has some grain in it. The grain adds to the palatability of the roughage and the roughage keeps the grain from forming a sodden mass in the lamb's stomach.

"Once more, never let your lambs get hungry. They'll gulp their feed down and trouble starts right there. Plenty of the right blend of a mixture of ground grain and chopped roughage before them all the time will keep them gaining, and give them that thick covering so much prized by the market."

The second floor of the Wall sheep-feeding barn has partitions, dividing the mow into bins into which are blown chopped sheaf oats, chopped corn fodder, chopped clover and alfalfa hay. In other bins there are ground soybeans, ground corn and ground wheat, all done by the same mill. The mixtures are blended on the second floor, and dumped into 6 big feed-hoppers, later to be shoveled into baskets, and distributed to the battery of feeders.

The Wall lambs are driven home from the car and right up to a feeder. Here they find a mixture of 25 lbs. ground corn, 15 lbs. ground oats, 15 lbs. chopped soybean roughage, 15 lbs. chopped alfalfa or clover hay, 15 lbs. chopped cornfodder, and 15 lbs. chopped sheaf oats. If the lambs weigh more than 60 lbs., they are gradually boosted to a ration of 65 to 75 lbs. of grain, mixed with from 25 to 35 lbs. of chopped roughage. If they are light lambs, that weigh under 60 lbs., they are kept on a mixture of 50% ground grain and 50% chopped roughage for the first 50 days—ground corn, 20 lbs.; ground wheat, 15 lbs.; ground soybeans, 5 lbs.; ground oats, 10 lbs.; and equal parts of chopped legume hay, chopped cornfodder, soybean hay, and sheaf oats. This means more roughage and less grain for the light lambs.

His method of feeding enables Joe Wall to keep a stream of lambs coming in lean and going out fat during the entire year. And out of his 4700 head, fed last year, his death loss was less than 1%.

# Fertilizing Legume Crops

**Condensed from The Fertilizer Review**

*Dr. T. B. Hutcheson*

IT was natural that the first use of fertilizer should have been on cash crops and on them alone. This was for the simple reason that ample plant food was present in the soil to produce some profit from labor expended on other crops without fertilizer, and a dollar spent on fertilizer for a cash crop gave greater returns per dollar invested than when the fertilizer was used on any other crop. Since, even for cash crops, the plant food returned to the soil often did not even approximate that lost each year through crops, erosion and leaching, the soils in many sections became poorer and poorer and no longer produced any profitable crops without the use of manure or fertilizer.

In livestock and general farming sections, little or no fertilizer was used. These soils were also depleted of their fertility, until now in large areas profitable crop production is no longer possible *for any crop* without the use of fertilizers.

One of the most hopeful signs of the present time is the realization, among an increasingly large group of farmers, that the virgin productivity of our soil has been reduced to such an extent that plant food must be added to the soil in amounts which at least closely approximate that removed by crops and farming practices, if yields are to be maintained. This has led to consideration of the amount of plant food needed for the entire cropping system rather than the needs of one cash crop.

Another marked advance in agriculture is the increased realization that soil reaction has an important bearing on the efficiency of purchased plant food, as well as that already in the soil, but that the proper soil reaction without plant food is conducive to soil depletion. In other words, we can hold plant food in the soil longer by keeping it acid, but plant food held in the soil is useless. Only that which is taken up by plants has a sales value.

There are no crops that do not use plant food, and all crops are soil depleting unless returned *in toto* to the soil. Certain crops, because of their habits of growth and their place in the rotation, reduce erosion and leaching. Legumes when inoculated, may

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gather nitrogen in amounts in excess of their own needs, but in doing so they use mineral elements in large quantities.

These have been called "soil-improving" and "soil-conserving" crops. Both terms are misleading unless qualified. Legumes may add plant food to soils only under certain conditions, and then they add only nitrogen. Sod crops may bind soils and cover crops may prevent leaching, but only when they are fed well enough to grow vigorously. Table 1 gives an idea of the amount of plant food removed by certain crops designated as soil-improving, soil-conserving, and soil-depleting crops.

It takes no argument to show that the "soil-improving" crops remove far more plant food from the soil than the soil-depleting crops. This is particularly true for nitrogen and potash. However, the legumes also remove more phosphoric acid. Presuming that the legumes are inoculated with virulent organisms and that they gather their own nitrogen, there is still a drain on the mineral elements.

The fact that both soil-improving and soil-conserving crops use large amounts of the mineral elements is further proved by the way these crops respond to applications of these elements to the soil.

The logical way to fertilize soil-conserving crops is to grow them in rotation with cash crops and soil-depleting crops and apply sufficient plant food to provide for the needs of all crops in the rotation. However, when any crop is grown for the purpose of conserving soils or for improving the nitrogen and organic content of the soil, it should certainly be fertilized. The degree of conservation and soil building is dependent upon the size of the conserving crop, and the size of the conserving crop is dependent upon the available plant food in the soil.

Where plenty of plant food is present, nature will establish soil-conserving and soil-building crops without assistance if given a chance, but neither nature nor man can establish good ground cover on dead, poor land. In my opinion, much of the erosion commonly attributed to tillage is due to poor land, and I am quite certain that little progress will be made in establishing ground cover on erosive soil until we realize that soil-conserving crops, like all other crops, must have plant food. In the mountain sections of Virginia a large proportion of the total erosion comes from pasture lands that have become so deficient in plant food that they no longer support sufficient vegetation for cover. The remedy is plant food.

In my opinion, the surface has

just been scratched in the use of commercial plant food. Up to the present time we have thougnt only in terms of plant food for cash crops. In the future we shall be forced to consider the plant food needs for all crops grown, if the fertility of our soils is to be improved or even maintained.

**Table 1**

**PLANT FOOD REMOVED PER ACRE**

| | Yield per acre | Nitrogen | Phosphoric acid | Potash |
|---|---|---|---|---|
| **Soil-Improving Crops** | | | | |
| Red clover | 2 tons | 83.6 | 17.2 | 83.2 |
| Crimson clover | 1½ tons | 61.5 | 12.0 | 39.3 |
| Vetch | 2 tons | 111.2 | 33.4 | 107.2 |
| Alfalfa | 4 tons | 188.0 | 43.2 | 178.4 |
| Soybeans | 3 tons | 160.0 | 40.0 | 110.0 |
| Cowpeas | 3 tons | 117.0 | 31.2 | 88.2 |
| Lespedeza | 2 tons | 76.0 | 40.2 | 80.4 |
| **Soil-Conserving Crops** | | | | |
| Timothy | 2 tons | 39.6 | 12.4 | 54.4 |
| Pasture | 2 tons | 50.0 | 22.0 | 40.0 |
| **Soil-Depleting Crops** | | | | |
| Corn with stover | 50 bu. | 68.4 | 22.9 | 39.7 |
| Wheat with straw | 25 bu. | 38.9 | 18.4 | 27.4 |
| Cotton with seed | 1 bale | 31.4 | 14.6 | 15.1 |

**Table 2**

**RESPONSE OF LEGUMES TO MINERAL ELEMENTS**

| **Red Clover on Frederick Clay Loam—Blacksburg, Va.** | Average 24 years' results Tons per acre |
|---|---|
| No fertilizer | .82 |
| Phosphate alone | 1.67 |
| Phosphate and potassium | 2.03 |
| Nitrogen, phosphorus and potassium | 2.14 |

| **Korean Lespedeza and Rye on Cecil Sandy Loam at Chatham, Va.** | Average 3 years' results Pounds per acre |
|---|---|
| No fertilizer | 2084 |
| Nitrogen and phosphorus | 3104 |
| Nitrogen, phosphorus and potassium | 6214 |

| **Soybeans and Rye on Cecil Sandy Loam at Chatham, Va.** | Average 3 years' results Pounds per acre |
|---|---|
| No fertilizer | 1690 |
| Nitrogen and phosphorus | 3136 |
| Nitrogen, phosphorus and potassium | 5772 |

# Breeding Pears for Half a Century

**Condensed from Farm Research**

*G. H. Howe*

**New York Experiment Station, Geneva, N. Y.**

PEAR growing in New York might be developed into a paying industry for the fruit grower if good varieties which are free from blight could be had. No disease of any hardy fruit has taken such a terrible toll from pear growers as has fire blight.

To achieve this aim the Station is engaged in an extensive pear-breeding program. The chief end sought in breeding pears is to obtain varieties less susceptible to blight than present-day kinds and possessing the splendid tree and fruit characters of some of the old-time sorts.

Many pear-crosses have been made with this end in view. At the close of 1936, 8,090 pear seedlings had been originated at the Station. About 4,200 of these have fruited and 9 kinds have been named and introduced by the New York State Fruit Testing Co-operative Association, Geneva, N. Y. All inquiries concerning them should be addressed to the Association. None of the nine new pears offered by the Fruit Testing Association are by any means perfect, but they all do meet in some measure the requirements set for a new variety of sufficient merit to be introduced.

Various combinations of varieties have been utilized as parents, and of these, Seckel and Bartlett have most often been used, the former because of its relative immunity to blight and the latter because of its high rank as a market and canning pear. Of the 1,500 or more seedlings of which Seckel has been one of the parents, 3 have been selected for introduction, namely, Early Seckel, Clyde, and Cayuga.

Early Seckel is an early-ripening Seckel. Averaging a little larger than Seckel it resembles its parent in appearance and taste. The color is brighter, developing into a deep reddish blush over one-half of the surface. The pears possess the rich, delectable flavor of Seckel which commends it to every palate. The season is from 2 to 3 weeks earlier than Seckel, but if the fruit is picked while still firm it will keep longer in storage than

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its parent. If allowed to ripen on the tree the pears soften quickly and are worthless within a day or two. Early Seckel is especially well suited for the local and roadside market. The tree, like its parent, is vigorous and hardy and as free from blight.

Clyde extends the season of its parent by 2 to 3 weeks. It is a Seckel type but possesses less color. The entire surface is light greenish russet, attractive enough, but lacking any blush. Like Early Seckel, the flesh of Clyde is tender, juicy, and buttery, with a rich spicy Seckel flavor, altho not quite as good as Seckel. Ripening as it does later than Seckel, it can be kept in storage long after Seckel is gone. The tree is of the Seckel type and is relatively free from blight.

One of the first pear seedlings to be named by the Station is Cayuga. It is similar to its parent, Seckel, in contour but is as large as a Bartlett. It is attractively colored with greenish yellow with a dull or sometimes bright blush. The flavor is quite as delectable as Seckel, altho milder and not as spicy. The quality can easily be rated better than most standard sorts except Seckel. Cayuga prolongs the Seckel season by several weeks. While the trees are large and fairly free from blight they are a little tardy in coming into bearing and are not always as productive as is desirable.

Of all the seedlings which have originated at the Station, the one named Gorham is by far the best from a strictly commercial aspect. A seedling of Bartlett, of the same general type, and ripening from 2 to 3 weeks later, it has all of the good points of its parent and fewer of its faults. It is handsome in appearance, is Bartlett-shaped, has a clear pale yellow color, and is as good as Bartlett in quality. Canning tests with Gorham, both in New York and in California, have shown the canned product to be equal to that of Bartlett and much better than Kieffer. Growers who have fruited Gorham are enthusiastic in its praise as a surpassingly good pear to supplement Bartlett. Gorham trees are larger and more vigorous than those of Bartlett. Also, they are as productive, but blight does sometimes take a heavy toll which is the most serious fault of this otherwise meritorious seedling.

Two seedlings of Winter Nelis crossed with Russet Bartlett, Pulteney and Phelps, were introduced 13 years ago as Bartlett types to extend the Bartlett season from autumn to early winter. The trees of both have consistently been resistant to the dreaded blight, a distinct point in their favor. Both sorts have the Bartlett shape and possess the Bartlett flavor except that

both are decidedly piquant. Phelps is duller than Bartlett in color and its surface is rougher and more pebbly than that of Bartlett. Pulteney, on the other hand, is smoother than Bartlett, a little more regular in contour, but with a greenish yellow color without a blush. It ripens from 4 to 6 weeks after Bartlett, while Phelps is in season at Thanksgiving, sometimes keeping well into December. While neither of these sorts does as well at the Station as some older sorts, favorable reports have come in from other sections where the soil is more favorable for their development.

Three winter pears have been originated at the Station and are now being introduced. In the order of ripening they are Covert, Ovid, and Willard, all crosses between Bartlett and Dorset. All three are shaped like Bartlett, but all are considerably larger. Covert has the least color of the three, being a dull green maturing into a dull greenish yellow without any blush. The surface is fairly smooth and is covered with an infinite number of minute greenish russet dots. The flesh is a little coarse but is filled with refreshing piquant juice. Covert is not a dessert pear. Its value lies in the canned product which is comparable to that of Bartlett and superior to Kieffer. The firmness of the fruit makes Covert one of the outstanding pears for shipping. Canadian pear growers are planting the variety extensively for export trade. The trees are hardy and vigorous and not too susceptible to blight. For productiveness they are unequaled by any other sort, bearing annually prodigious crops of the largest-size pears.

Ovid and Willard are about the best of the winter pears from the standpoint of size, appearance, and quality. Neither has the fine aroma and delectable flavor of the small Dana Hovey, a veritable sweetmeat which should be found in every home orchard, but they make up in size and lateness in keeping what they lack in high quality. Ovid is the more attractive of the two because it develops a handsome pinkish red blush mingled with patches of light russet. The blush on Willard is of a duller brownish red. The flesh of both is finer grained than that of Covert and, while the flavor is piquant, it is agreeably flavored and refreshingly good for dessert. Both ripen in December and are about at their best at Christmas time, the season in storage extending well into January. Willard is a little later than Ovid and will extend the season of that variety from 2 to 3 weeks. Both sorts far outstrip in every character the once popular winter pears such

as P. Barry, Duchess, Dorset, and Winter Nelis.

With the continuance of pear breeding at the Station, it is earnestly hoped that in time a new race of surpassingly good pears may be developed covering a long season, thereby giving the necessary stimulus to bring the art of pear growing out of the doldrums and to reestablish the industry to a point far in advance of the fine old pear orchards of other years.

# The Place of Minerals in Swine Nutrition

Condensed from Scientific Agriculture

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**Evidences of Malnutrition in Swine**

*CALCIUM and Phosphorus*—In any discussion of mineral malnutrition it is difficult to separate calcium and phosphorus, because bone metabolism and bone growth involve both elements to such a great extent, and because the adequacy of the intake of either element in covering the animal's requirements and in avoiding nutritive disaster depends so largely upon the intake of the other, particularly when the conditions for the assimilation of both are unfavourable in the absence of vitamin D or of ultraviolet radiation. About 99% or more of the body's store of calcium is found in the bones, while the proportion of body phosphorus so located, though quite variable depending upon the ratio of skeletal to soft tissues (and hence upon stage of growth) seems to be about 80%.

In the nutrition literature the pathological condition resulting from the nutritional disturbance of bone growth in very young animals is almost universally referred to as rickets. Biochemically this condition is characterized by subnormal levels of inorganic phosphorus or of calcium in the blood, and by low percentages of mineral matter in the bones. However, the pathological condition existing in the bone varies, being either osteroporosis or true rickets, the latter condition being clearly distinguished from the former, first, by the presence of the rachitic metaphysis, a marked widening of the epiphyseal cartilage, and, second, by its occurrence only in very young ani-

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mals. A confusion of osteroporosis with rickets, merely because they have not been clearly distinguished biochemically is unforunate from any standpoint and may account in part for the observed differences between species with reference to the relative vitamin D potency of different so-called "anti-rachitics."

Pregnant sows on low-calcium diets may become lame, have difficulty in farrowing, secrete little milk, and may raise only a small proportion of their young to weaning age.

However, swine may grow for many months with unimpaired vigour on cereal rations with no calcium supplements, provided vitamins A and D are made available in adequate amounts, and in young pigs it is unlikely that a phosphorus deficiency will occur under practical and normal conditions of feeding. On the other hand a calcium deficiency is to be expected unless special provision is made against it.

Theiler has said: "The normal functioning of the mineral metabolism of an animal depends upon the harmonious interaction of three dietary factors: vitamin, calcium and phosphorus. The absence of any one of them might be expected to have the same result in all animals, but in practice this does not seem to be the case. Some species react more readily to one deficiency than another."

An excess of either calcium or phosphorus in rations for swine will tend to impair the utilization of the other minerals and to induce deficiency symptoms.

*Iodine*—Goitre is the result of a deficient supply of iodine in the food and water and is remedied by administering iodine to the breeding stock either as iodides or as iodized salt during the gestation period, or, in extreme cases, to all stock the year round.

*Iron and Copper*—Among the many factors that probably contribute to the prevailing high death rate in suckling pigs is nutritional or milk anemia. This condition results from the exclusive feeding of milk to new-born pigs for periods of three to four weeks after birth, with no access to earth or vegetation, and is traceable to a deficiency in milk of iron and copper. Nutritional anemia is prevented in practical swine husbandry by assuring a supply of iron and copper to the new-born pigs. The nutrition of the sow prior to or during lactation is entirely unrelated to the occurrence of nutritional anemia in her pigs.

*Sodium and Chlorine*—The breakdown in health due to lack of salt is marked by "loss of appetite," a generally haggard appearance, lustreless eyes, a rough coat, and a very rapid decline in live weight.

There is apparently a close relationship between sodium requirements and the adrenal glands, such that large doses of sodium chloride relieve the symptoms of adrenal insufficiency.

**Availability and Utilization of Minerals**

The utilization of minerals in the ration is modified by many factors relating to the ration or to the environment. The chemical combination in which a mineral occurs in the ration, concentrations of other minerals and inorganic radicals, the concentrations of certain of the organic nutrients, particularly the vitamins, the accessibility of sunlight to the animal, may all depress or increase the utilization of the mineral in digestion and in metabolism.

*Vitamin D*—The proper assimilation of calcium and phosphorus in the young growing animal is dependent upon an adequate supply of vitamin D, either by adequate exposure of the animal to sunlight, or to some other source of ultraviolet light, or by the incorporation in the ration of food materials rich in vitamin D. The indispensability of vitamin D in the nutrition of the adult pig has not been satisfactorily established.

**Mineral Requirements of Swine**

The total requirements of growing swine for calcium and phosphorus (with adequate vitamin D provided), expressed as a percentage of the ration fed, have been assessed as follows:

*Calcium requirement*—
0.34% or less—Dunlop
0.37%—Axelsson
0.30%—Spildo

*Phosphorus requirement*—
between 0.27 and 0.30%—Hughes & Aubel
between 0.30 and 0.35%—Garrigus & Hunt
0.53% or less—Dunlop
0.20%—Axelsson
0.38%—Spildo

Thus, taking an average of these recommendations, the requirements are not far removed from 0.30% for both calcium and phosphorus.

The utilization of feed calcium is assumed to be 70%, largely on the basis of results of the Illinois Station on the calcium and phosphorus metabolism of growing swine.

Spildo estimates the growth requirements of pigs to be 5.0 grams of dietary calcium and 5.7 grams of dietary phosphorus, based on a day's gain in body weight of 500 grams, containing 0.58% of calcium and 0.57% of phosphorus. The percentage assimilations are taken at 60 for calcium and 50 for phosphorus. The growth requirements, expressed in ration percentages, would be 0.25% of calcium and 0.28% of phosphorus. The percentages given above include a maintenance quota assessed according to the Sherman method.

The necessary percentages of calcium and of phosphorus decrease as the size of the pig increases.

Hogan has estimated that the rations of brood sows should contain not less than 0.4% of calcium for the most successful reproduction, as judged by the offspring produced and a study of the bones of the sow.

The necessary calcium level increases during pregnancy from 0.22% up to 0.43% on the dry ration, and the necessary phosphorus level from 0.19% to 0.28%. The daily depositions of calcium and phosphorus for fetal growth are about equal at the eighth week of gestation, while at the sixteenth week, more than twice as much calcium as phosphorus is deposited daily. At parturition, the products of conception for an average litter of eight pigs contain 101 grams of calcium and 60 grams of phosphorus.

No quantitative information has been found of the calcium and phosphorus requirements of lactating sows as determined by feeding tests of any description. The extra requirements will of course depend upon the amount of milk produced and its composition. On the basis of the interesting study of Hughes and Hart, it may be computed that sows produce an average of 6.8 pounds of milk daily during a lactation period of 8 to 12 weeks, the maximum production being attained between the second and the fourth weeks. The composition of the milk varies considerably throughout the lactation period; on the average it contains 0.277% of calcium, 0.165% of phosphorus, and 1.44 calories of gross energy per gram. An average day's production (3084 grams) contains 8.54 grams of calcium, 5.09 grams of phosphorus, and 3434 calories of gross energy.

*The Requirements for Iron and Copper*—No quantitative information in regard to the requirements of farm animals for iron and copper is available.

Undoubtedly the need of iron and copper for hemoglobin production and regeneration determines to a large extent the total requirement for these metals. However, the fact that it is possible to increase the iron and hemoglobin content of the blood of pigs above what may be considered normal or adequate levels does not indicate that ordinary rations should receive iron supplements until some definite benefit to the animal is shown to follow this hyperhemoglobinemia.

The iron or copper requirements of the animal may be greatly increased if it is producing products rich in these metals. For example, a pregnant sow stores up a total of 580 mgms. of

iron in the products of conception and in the last three weeks of pregnancy she is storing iron at the rate of 9 to 12 mgms. daily, probably equal to several times her own body requirements.

*The requirements for Iodine*—Orr and Leitch, in a very thorough review of iodine in nutrition, state: "Regarding the iodine requirements of farm animals we have no definite information. Nor can we deduce the requirements of animals from a knowledge of the amount required to prevent goitre, for as yet no standard and adequate dosage has been determined." However, from the iodine content of feeds and usual consumptions they have computed about the amounts of iodine that different kinds of animals consume daily in non-goitrous areas. Their estimates for swine follow:

| | Body wt., lbs. | Daily iodine consumption (micrograms) |
|---|---|---|
| Pigs, weaned ... | 50 | 40–80 |
| Sows ..... | 400 | 200 |

Welch recommends three grains of potassium iodide weekly for pregnant sows for three months, and a total of 1.2 grams, equivalent to 10.2 mgms. daily, although admitting that this is probably at least three times as much as needed.

*Salt (NaCl) requirements*—Morrison and Evvard recommend for swine 0.03 to 0.12 ounce of salt per head daily.

*Water requirements of Swine*—Water requirements are ordinarily not considered along with mineral requirements, but no apology is needed for considering water in a paper of this sort, since water is a mineral and since the intake of minerals is one of the determinants of the requirements of water.

The amount of water needed by an animal is increased by the loss of water (a) in the pulmonary circulation, determined by the rate of ventilation, the percentage saturation of the inspired air, and the temperature of the body, (b) insensible perspiration through the skin, bearing a definite relation to the heat loss from the body for a definite environmental temperature and for definite humidities above a certain high percentage saturation, (c) the sensible perspiration, related to the amount of muscular exercise and to atmospheric conditions, and (d) the alimentary output of water, related to the amount and character of the food consumed.

*Nutritional Anemia* may be prevented by the direct feeding of reduced iron or a commercial iron salt such as ferric sulphate or ferric chloride. A practical method is to place in the pen sods or earth to which an iron salt has been added.

*Phosphorus*—Since the cereal grains themselves (with the exception of rice) contain 0.3 to 0.4 or somewhat more of phosphorus and since the usual protein supplements are much richer than this in phosphorus, it seems clear that rations for growing swine do not require supplemental quantities of this mineral.

*Calcium*—The calcium deficiencies of a ration may be adequately taken care of by the supplemental feeding of ground limestone or calcium carbonate. In the instance of skimmilk or protein-rich concentrates of animal origin being fed there is not such a probability of a calcium deficiency as when protein concentrates of vegetable origin are fed.

As a source of both calcium and phosphorus feeding bone meal may be fed.

The feeding of the pregnant sow with respect to calcium and phosphorus is quite similar to that of the growing pig; as she progresses in pregnancy her mineral needs approximate in intensity more and more nearly those of the weanling pig, so that during the last week of pregnancy she requires about as large a concentration of calcium and of phosphorus in her ration as does a 50-pound pig. A lactating sow, requiring an average of 0.45% of calcium and 0.37% of phosphorus in her ration on the dry basis, also presents the same sort of a picture as the weanling pig.

*Vitamins*—The provision of a dependable source of the vitamins is necessary to mineral assimilation. Sufficient literature relative to this phase of nutrition is available and it remains for the feeder to make use of opportunity.

*Goitre* with its accompanying complications may be prevented by the feeding of iodine along with the regular ration.

# Correcting Nature's Mistakes

**Condensed from California Cultivator**

*Henry J. Beckman*

OVERHEAD irrigation is nature's method. Long before the skill of engineers combined with the patience of the man with the spade to bring water from the bowels of the earth and spread it over level land, rain fell from the heavens and plant life responded to its magic touch.

But nature distributed her rainfall irregularly, leaving many places barren and parched so long that they became veritable deserts. It was to remedy this condition that irrigation systems came into existence. Creaky, old wooden water wheels in far off China, manipulated by cheap labor, dipped crude boxes of water from muddy streams and emptied the life-giving fluid in tiny rivulets on higher ground. Other forms of irrigation projects came into being. With dams thrown across streams, there began the age old system of gravity irrigation.

Many places, because of their location, cannot apply gravity water and must be supplied from wells so pumping plants were devised. The modern types are very efficient.

But neither the system nor the modern equipment has eliminated the stern necessity of leveling the land when the furrow or flooding system is used and this stands as a handicap to the use of irrigation on many farms somewhat uneven and difficult to grade. Rolling hillsides make irrigation, except in a limited way, practically impossible.

Into this gap has come a new agency, overhead irrigation, which applies water nature's way. This type of water application secures high germination by keeping the soil in the best condition to sprout the seed and bring the young plant to the surface and usually results in a good stand. Like rain, it bathes the plants in spray; washes dust from the leaves and stems and keeps the pores open. Harmful insects are often washed from the plants and there is no loss of water through heavy run off.

Vest pocket overhead irrigation systems, either fixed or movable, have long been popular equipment for lawns, golf courses and parks. The revolving sprinkler idea is well established. The success of the overhead system

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for such service is not questioned. But when it came to overhead irrigation of field crops of considerable acreage, many good farmers shook their heads. It remained for the East Side Ranch at Firebaugh, Fresno County, to make a real large-scale test; overcome the doubt and write the answer indelibly on the rough, virgin soil along the banks of the San Joaquin River. One gasps for a moment as he catches his first glimpse of what is probably the largest overhead irrigation system, not only in America, but in the world. Spraying water through the air with sufficient force to produce overlapping strips 100 feet wide, is a line of revolving sprinklers reaching 1100 feet across the field on either side of the mains. Made of four-inch galvanized pipe this portable line is built up of quick-coupled sections, each one with a riser and sprinkler. Running at seventy pounds pressure the sprinklers throw an acre-inch of water per hour and in two hours the equivalent of a two-inch cool, refreshing, cleansing rain falls. On this ranch a total of 140 acres is covered in twenty-four hours by the use of three large systems operated by booster pumps which consume 350 horsepower of electric energy and pump 8000 gallons of water per minute.

Back of these streams of whirling spray is a big story of hard, stubborn facts, engineering problems and of vision and foresight. Coupled with it all was a spirit of daring adventure and a willingness to invest no small amount of money to try out the idea. But there was reward in the fact that today over 1400 acres of that land teem with rich green cotton that will average a bale and one-half to the acre.

How long those acres lay slumbering and undisturbed along the banks of the old San Joaquin River no one dares to guess. For centuries nature fed them; overflowing river waters added their rich alluvial blankets in years of heavy rainfall; cattle, grazing over them, left droppings to help enrich the land where from time immemorial wild life had held full sway. When other sections of California were graded and planted to crops, these rich acres remained untouched because the rough, uneven character of the land made leveling for ordinary irrigation economically impractical. Overhead irrigation seemed to be the only answer.

But another problem presented itself. Cotton was the logical crop. What effect would overhead irrigation have upon cotton? No one seemed to know. To this question the East Side Ranch now has a satisfactory answer, for no damage seemed to result to the squares, and certainly no

cotton field in California gives greater promise.

Water is supplied to this 1400-acre tract by the main canal running through the ranch. Strategic locations were chosen for the three big pumping systems, the first of which was built in 1935. Stub canals run from the main canals to these pumps where the water is strained through a screen, and pours into the box from which the booster pump forces it into the main or permanent lines. These mains are from eight to twelve inches in diameter depending upon the amount of land they serve. The longest is nearly three miles, the shortest three-fourths of a mile.

Powered by motors ranging from 75 to 150 horsepower, the pumps serving the three systems have a combined capacity of 8000 gallons per minute and force water into the lines at tremendous pressure. The smallest system covers 200 acres with eight-inch mains, the second system covers 450 acres with ten- and twelve-inch mains, and the largest pump covers 700 acres with eight- to ten- and twelve-inch permanent mains. Attached to the valves in these permanent mains by rubber elbows made of six ply material, are the four-inch portable galvanized lines that take off across the field and from which, at forty-foot intervals, the risers spray the water. Rapid action couplings, for ease and speed of operation, connect the sections and two men quickly string a new line while one strip of land is being irrigated.

Six miles of mains and four miles of portable lines are now used on the ranch. When the cotton plants are small, four men are employed with each system to keep the portable pipes moved, relaid and joined. However, when the plants become larger and handling the pipe is more difficult, six men are employed on each system.

The first system which was installed in 1935 covered 100 acres. In 1936, 400 acres were brought under a permanent line system. Today approximately 1400 acres are under the permanent mains, and the cotton is wet as frequently as needed.

Results have been very encouraging. Moisture penetration is satisfactory in spite of the rough character of the soil. No ditches are needed in the fields, thus facilitating the cultivation of the crop. Where the soil is good, a perfect stand is obtained because the crop can be planted dry and irrigated to bring it up. There is a marked saving in the amount of water required because of the uniformity of distribution. The cost ranges around 50 cents per acre-inch, twenty-one inches of rain per year costing about $10 per acre.

But the most important feature is that land too rough for successful leveling is now producing bumper crops. Herein lies one of the most important of the many possibilities of overhead irrigation. Installation costs vary depending upon the size and cost of the pumps, mains, etc. In this case much of the heavier equipment was built on the ranch. The installation costs ran from $25 to $30 per acre, probably considerably less than the expense of leveling such land would have been.

# Foal Feeding

**Condensed from The Draft Horse**

*L. P. McCann*

**Ohio State University, Columbus, Ohio**

FOALS like all other young animals make their cheapest gains during the nursing period. Because of this the mare that is a heavy milker gives her colt a much better start in the world than the mare which produces only a limited milk flow. Mares that are required to do regular duty in the field and nurse a foal at the same time should be fed much more liberally than others. The heavier a mare milks the greater is her need for additional good feed. The milk produced by the average mare during her nursing period is a far greater drain on her vitality than the production of the foal up to the time of its birth.

When foals are dropped late and the mares are worked during hot weather the udder should be partly stripped out before the foal is allowed to nurse at noon and in the evening. Better still, she should be allowed to rest 10 or 15 minutes at such times before the foal is allowed to nurse at all.

Getting the foal taught to eat grain under these circumstances is very important. When colts are in pasture a creep can be constructed through which they can get to a feedbox of their own. In the stall a separate feedbox should be erected at a convenient height so that the foal can eat without being bothered by the mare.

Oats are more widely used for foals than any other feed. Although corn is frowned upon by some,

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many successful horsemen use it extensively in rations for foals, young growing horses and mature animals of all kinds. Suggested combinations of feed for foals:

*No. I*
Oats, 2 parts; Bran, 1 part
*No. II*
Crushed oats, 2 parts
Cracked or shelled corn, 2 parts
Bran, 1 part
*No. III*
Shelled corn, 1 part
Whole oats, 1 part

Other feeds not mentioned in these combinations may be used to tempt the foal's appetite. Legume hay is an important item in all horse feeding, but is of special value to the foal and young growing horse on account of the protein it supplies for body building. Alfalfa hay and soybean hay are the best of legumes and they are finding more extensive and popular use among horsemen each year.

Good pasture is an important factor with growing foals. In addition to the feed value it also provides the necessary exercise to keep him clean and sound in his legs. During the short grass season and fly months of late summer it is wise to give foals access to a darkened stall in the daytime, but even during this period they should not be shut in a dark stall with no opportunity to get out-of-doors at will. If mares are not kept at regular work during this season, pasture is the best place for both the mare and foal.

It is false economy to starve a colt during its first year because at no other time in his life is it possible to make gains so cheaply. It is particularly important that young colts be given all the grain they will clean up. A good drafty colt well-grown out should reach at least one-half of its mature weight when it is one year old. Feeding is most frequently the determining factor in this matter of weight and gain during the first year.

Before the colt is weaned it should be thoroughly accustomed to eating grain and some hay, so that there is little or no setback when it is taken away from the mare.

The common practice in weaning draft colts is to take them off the mare between four and six months of age. If the mare is working every day, the colt is usually weaned at a younger age than if the mare is idle or not doing heavy work. The cheapest gains are made during the suckling period, and for this reason, it is wise to prolong the nursing period as much as possible.

Foals may be weaned by separating them from the mare and not allowing the two to come together again until the weaning process is completed. At this time

it is well to watch the mare's udder. If she is producing a heavy flow of milk, it is a good practice to partially milk out the udder once or twice a day for three or four days. At this period the mare's feed should be reduced for a few days until the milk flow ceases. If the udder becomes distended and shows any tendency toward feverishness, an application of camphorated oil twice daily will help.

# A Dry Calf-Starter

**Condensed from Successful Farming**

*Paul E. Newman*
New York State College of Agriculture

THE average dairyman in areas where fluid milk enjoys a good sale is up against it—he wants calves and he wants cash.

The feed cost of raising a calf to 6 months of age in market milk areas frequently represents one half or more of the total cost of raising the calf to freshening age. This high milk feed cost in itself is an important problem. In addition, a second and still more important problem results. Under such conditions many calves are scantily and poorly fed and they never develop the size or strength of bodies essential for their greatest productive ability as cows.

Because of the seriousness of the calf-feeding problem, Cornell University, Ithaca, New York, has given considerable attention to the development of a simple and satisfactory method of raising calves on a minimum amount of milk. The following points, which are essentials for any entirely successful method of raising calves, have been kept constantly in mind: 1. Rapid and even growth so that a cow of large size is produced. 2. Development of large, capacious bodies which will make possible later use of large amounts of roughage for milk production. 3. A reasonable cost from the standpoint of feed and labor required. As a result of several years of study, the Cornell Dry Calf-Starter Method of raising calves has been developed. The method has proved very satisfactory in the University herd and is now being used by a large number of New York dairy farmers.

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The important feature of the method is a palatable, dry meal which can largely take the place of milk in calf raising. This meal, or Dry Calf-Starter, has the folowing formula of everyday ingredients:

| | |
|---|---|
| Ground yellow corn | 32.25 pounds |
| Rolled oats (oatmeal) | 28.00 pounds |
| Wheat bran | 10.00 pounds |
| Linseed meal | 5.00 pounds |
| Whitefish meal | 3.00 pounds |
| Dried skim milk | 20.00 pounds |
| Steamed bone meal | .50 pounds |
| Ground limestone | .50 pounds |
| Salt | .50 pounds |
| Cod-liver oil reenforced for vitamins A and D | .25 pounds |
| | 100.00 pounds |

The essential features of feeding calves on this starter are as follows:

A total of 350 pounds of milk is allowed per calf. For Holsteins and calves of other large breeds this is given over the first 7 weeks. A schedule which allows 8 pounds per day during the first week, 9 pounds the second week, and 10, 9, 7, 6, and 4 pounds daily during the respective succeeding weeks will just about use 350 pounds of milk per calf. Jerseys and Guernseys are allowed the same total amount of milk but they are never given more than 7 pounds daily and are fed milk during the first 10 weeks.

When the calf is 2 weeks old or even earlier, the starter is placed in a trough conveniently located. Dry Calf-Starter is always kept before the calf, allowing it to eat as much as it will until a level of 4 pounds daily is reached for calves of the larger breeds and 3 pounds for the smaller breeds. The calves are usually about 3 months old by this time. The calves are then limited to these levels and fed twice daily. At 4 months of age the Dry Calf-Starter is discontinued.

Calves do just as well if fed in groups as if fed individually, provided the groups consist of calves of much the same age and they are not crowded into pens which are too small.

After the calves reach the upper limit of Dry Calf-Starter, an additional 1 pound daily of growing mixture is given them. Any simple mixture comparable to 3 parts each of corn, oats and wheat bran, and 1 part of linseed meal is entirely satisfactory. When the calf is 4 months of age, the dry starter is replaced by an equal amount of growing mixture. This is continued to at least 6 months of age.

It is very important that the calf at all times has all the clean, leafy, fine-stemmed hay it will eat. Good mixed legume-timothy hay is fully as satisfactory as all-legume hay. The hay should be fed in a conveniently located rack with a tight bottom to insure a maximum consumption and a minimum wastage of hay. When

fed in a manger the top leaves and fine stems are picked out, leaving a layer of coarse stems which keeps the young calf from getting to the more palatable hay below. Large amounts of hay are essential for developing capacious middles on calves.

Clean, fresh water should be kept before the calf at all times, since it does not receive the liquid it normally would in milk.

The sales of Dry Calf-Starter from the Grange League Federation stores during the past year have totaled 586 tons, which means that over 4,000 calves have been raised by this method during the past year.

When the Dry Calf-Starter Method as here outlined is followed, calves of excellent growth and development are consistently produced. Gains 10 percent greater than are considered average for calves raised on a combination of whole milk and skim milk are obtained. The depth of body, spring of rib, and strength of top line are especially desirable. A thrifty growing condition is maintained uniformly from birth.

The feed cost of raising a Holstein calf to 6 months of age by this method is approximately $23. On the whole-milk method it is at least $30 even when the milk is limited quite severely.

The method is simple and as nearly fool-proof as possible. No pail feeding is required after the first 7 weeks. The feeds are largely self-fed. Thus very little pail washing, weighing of feed, warming of milk or gruels is necessary. Practically no scours or other digestive trouble are encountered in the calves.

Professor E. S. Harrison, who is in charge of the Cornell University dairy herd, has come to believe so thoroly in the method that he is now growing all their calves on Dry Calf-Starter. He states:

"The development of a superior dairy cow depends upon two major considerations: (1) the inherited productive ability which is determined by breeding; (2) opportunity which permits development in accordance with the inherited productive ability.

"The growth and development secured with groups of experimental calves reared by the Cornell Dry Calf-Starter Method convinced me that this method of raising calves offered a solution to our problem. Accordingly I fed a group of our best calves on the starter. These calves made remarkable development. They possessed deep, strong, and capacious bodies and carried a bloom hitherto unknown."

# Harvesting, Curing and Marketing Sweet Potatoes

Condensed from Southern Agriculturalist

*J. Edwin Holleman*

THE successful sweet potato grower uses a great deal of caution in harvesting the crop. In digging sweet potatoes an implement should be used that does not cut or bruise the roots. A splendid type of digger is a plow with rolling colters on the beam to cut the vines and with rods attached to the mold-board to free the potatoes from vines and soil. A "middle buster" is also a good implement for digging sweet potatoes. After the potatoes are dug they should be scratched out by hand and allowed to remain exposed long enough to dry. They should never be thrown from one row to another, thrown loose into the wagon bed, or put into bags. The digging should be done, if possible, when the weather is bright and the soil dry.

Grading of sweet potatoes should be done in the field, in order to reduce the cost to a minimum. A good plan is to go over the rows and pick up the sound, marketable roots in one basket, then gather all the seed stock in another basket and put the injured ones in still another. These baskets should be hauled directly to the storage house. Sweet potatoes can be stored in boxes, hampers, baskets, or bins with satisfactory results.

When crates are used, a slat floor raised four inches from the main floor should be provided, in order to allow air circulation under the crates. Crates should be stacked in even rows to the height of eight feet. A good method is to stack each row of crates on two 2x4-inch pieces set on edge, parallel to each other, and about 1 foot apart, thus permitting ventilation under the crates. In this way the pieces act as a substitute for a slat floor. It is important to do this in order to protect the roots in the first row of crates.

A fire should be kept in the storage house while the newly havested potatoes are being brought in. A temperature of 80° to 85° F., with plenty of ventilation, should be maintained for 10 days or two weeks, depending on weather conditions and the variety of sweet pota-

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toes. Ventilation is absolutely necessary, and even if it is not possible to keep the temperature up to 85° it is necessary to leave the doors, windows, and ventilators open, so as to drive out the moisture-laden air. The doors and windows may be closed at night and should be kept closed on cloudy days. Some of the ventilators in the floor and through the ceiling should be kept open throughout the curing period, even in cloudy or rainy weather. The air inside the house should be kept warmer than the outside air during the curing period. This will prevent moisture from being deposited on the walls. When the roots are thoroughly cured, the temperature should be gradually reduced to 55° and kept as near that point as possible during the remainder of the storage period. If the temperature goes below 48° a fire should be made and the temperature raised to 55°. When the temperature goes above 60° the house should be opened in the cool of the day to lower the temperature to 54° or 55° and then closed. In mild weather the ventilators in the roof may be partly open all of the time, but they should be closed in cloudy or cold weather.

The length of time required for proper curing of potatoes cannot be stated as definitely as can the temperature and humidity requirements. The condition of the crop at harvest, the weather during the curing period, the manner of placing the sweet potatoes in the storage house (whether in baskets, crates, or bins), and the efficiency of the house and its operation all help to determine how rapidly the curing process will go along. In practice, the length of the curing period ranges from 10 days to 3 weeks, and sometimes longer. Three weeks is generally too long. Observations and the experience of successful persons show that in general the curing temperature should be kept up for 10 to 15 days.

The maintenance of a too-high storage temperature will cause excessive further shrinkage, and letting the temperature fall too low may cause more disastrous results.

On many farms in the South there are abandoned tenant houses and various other buildings that can be converted into sweet potato storage houses at very little trouble or expense. In many towns there are warehouses, store buildings, and other structures that can be utilized to advantage for storing sweet potatoes. Where such structures are available on the farms or in towns they should be utilized before new storage houses are built.

If the most satisfactory results are to be obtained in the storing of sweet potatoes, the following 7 important recommenda-

tions of the U. S. Department of Agriculture should be carefully observed. (1) The storage house must be clean and sanitary; (2) the crop must be harvested before it is injured by low temperature in the fall; (3) particular care must be taken to avoid cutting, bruising, or otherwise injuring the sweet potatoes during digging, picking up, grading, placing in containers, and moving to the storage house; (4) injured roots or roots showing evidence of disease must be carefully excluded from storage; (5) the sweet potatoes must be thoroughly cured immediately after being put into the house; (6) the proper storage temperature must be maintained after curing; and (7) the hazards of spreading disease in the house must be avoided by leaving the sweet potatoes undisturbed until they are removed from the house and by insuring as far as possible that the house is mouse-proof.

The main reason why Southern farmers have not received better prices for sweet potatoes is that they have not used proper methods of handling and marketing. In many cases the roots are badly bruised and cut in digging, put in bags or rough barrels without being graded, and rushed to market when there is an oversupply. The secrets of success in getting high prices are to carefully grade, clean, and pack the product and to put it on the market when there is a good demand. Usually the greatest demand is from the middle of December to the middle of March.

When the sweet potatoes are to be marketed they must be carefully graded, no matter how well the grading was done when they were put in the storage house. The market demands a medium-sized, uniform type of sweet potato, free from bruises or decayed spots.

After being carefully graded, the sweet potatoes should be put into clean, neat, atractive packages. Bags should never be used, as the roots in them become badly bruised. The smaller type of package such as the bushel hamper, bushel box, or basket, is becoming more popular each year. A neat and attractive package of well-graded sweet potatoes will bring a better price than ungraded ones at almost any time, even when the market is greatly overstocked with inferior goods. The consumer today is discriminating and demands attractiveness and high quality in food products.

# Effects of Thyroxine on Production

Reprinted from Guernsey Breeders Journal

*H. A. Herman, W. R. Graham and C. W. Turner*

Missouri Agricultural Experiment Station

IT has been previously demonstrated that the injection of thyroxine in cows in the declining phase of lactation will increase milk secretion.

In view of these findings which are confined to only a few observations, it was decided to investigate this problem further, particularly because of its striking significance in the endocrine control of milk secretion. Cows in the various stages of lactation were selected for this project so as to demonstrate the effects of thyroxine on cows at the peak of their production, in the early declining phase, and also at the approximate end of lactation. Inasmuch as thyroxine raises the metabolism level, feed consumption has been carefully checked and the weight of the cows obtained weekly.

The project is divided into two phases: (a) the feeding of dessicated thyroid at levels of two ounces daily, and (b) the injection of thyroxine daily in doses of five to ten mg.

In the thyroxine feeding six cows at the peak or just past the peak of production were used. Two cows at the peak of production showed little response in the way of an increase in milk and fat production, but for nine weeks maintained a consistently high level of production (about 50-55 pounds daily) and immediately dropped to an average of forty-two pounds per day when the thyroxine feeding was discontinued. Four cows just past the peak of production showed increases in daily milk production of sixteen to thirty per cent. The production declined rapidly when thyroid feeding was discontinued for a four weeks' period. Resumption of feeding, however, demonstrated a rapid rise in daily production even though most of the cows were in the twenty-fifth to thirtieth week of lactation. In one case the increase amounted to 344.5 per cent, but averaged approximately twenty per cent for all animals in the group.

The injection of five mg. thyroxine daily in four cows was noted to give increases in daily milk production of approximate-

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ly fifteen per cent when the cows were just past the peak of production. After three weeks, injection was discontinued, and then resumed after the cows had been in lactation from 160 to 180 days. In the second period of injection ten mg. of thyroxine was being injected daily. This phase of the experiment is not complete but during the first week of injection, increases of ten to twenty per cent in daily milk production, with a marked rise in fat percentage, was evident.

The percentage of fat in the milk produced was increased by both thyroid feeding and thyroxine injection. The solids-not-fat are apparently slightly increased during the periods of injection or feeding.

Three cows injected with thyroxine (ten mg. daily for two weeks) at the peak of their production have shown a rapid decline in daily production.

There was no marked change in the weight of the cows during the phases of thyroid feeding or thyroxine injection completed thus far.

# For Sake of Argument

Condensed from Eastern States Cooperator

*Philip H. Smith*

Massachusetts Agricultural Experiment Station

SOME 40 years have elapsed since enactment of the first feeding stuffs legislation in Massachusetts. The original bill required simply a guarantee of protein and fat. Later the requirement of a fiber guarantee was added, and still later, a complete statement of the ingredients used in the manufacture of mixed feeds became a part of the guarantee. The manufacture of special purpose feeds did not originate until about the time of the enactment of the first feeding stuffs legislation and in the first Massachusetts bulletin published we find mentioned as being of special interest, that one or two manufacturers were mixing dairy feeds. Experiment stations, which at that time carried much of the work now taken over by extension services and county agents, apparently did not look with favor upon this new departure and continually talked and possibly railed on the subject of home-

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mixed rations, all of which had little effect on the general trend, as today it is safe to estimate that fully 90 percent of the feed consumed by cattle and poultry is purchased ready-mixed.

It is quite safe to assume that feeding stuffs legislation has not kept pace with research in nutrition and that the feeder should understand the limitations of the guarantee required by law. Formerly feeds were simply concerned with the digestible protein, fat and carbohydrate content of feeds and the proportions of each most satisfactory to use were based very largely on accepted standards. While these were probably correct insofar as they went, our knowledge of nutrition has increased to such an extent that we now also know that the feeds mixed in accordance with such standards may not be, at all times, adapted to the purpose intended. Is it unreasonable to expect that our so-called fodder analysis used for so many years as a basis for evaluating feeds may not be entirely discarded? The determination of water, protein, fat, nitrogen-free extract, fiber and ash, of which such an analysis consists, is at best only a rough estimate of the true value of a feed. The best excuse for its continued use is that it brings substances of similar chemical composition into definite groups, and from a control standpoint the ease with which such determinations are made makes possible the examination of a large number of feeds at a minimum cost. We now know that p r o t e i n from different sources as determined by ordinary chemical methods differs somewhat widely in its functions in nutrition and that a blend of proteins from different sources is of more value than that derived from one source. The ingredient fat, or ether extract, may be almost entirely devoid of true fats or oil and might conceivably consist of waxes, the chlorophyl or green matter of leafy plants, and other material which is extracted by ether in the determination of fat. Ash may conists almost entirely of silicia or inorgantic dirt or may contain a considerable proportion of calcium, phosphorus and other mineral ingredients of value in nutrition. Recent investigations on leafy plants used in human nutrition indicate that our chemical determination of crude fiber may not be at all comparable with the results found in the chemical laboratory of the alimentary canal.

The problem of efficiency of feed control work is further complicated by the discovery of vitamins and the role that they play in nutrition.

All of which leads up to the value of the guarantee required by statute to the purchaser of

feeding stuffs. If the feeder will accept the guarantee for exactly what it is—a mere statement of the composition of the feed—it will be of value to him in deciding its suitability for his use. He should not take the guarantee as fully proving the value of the feed. The manufacturer is simply stating on the label what is required of him by statute and it is quite possible for him to make an inferior feed and fully comply with the law. A dairy feed may be composed of high grade oil cakes brought down from 40 per cent protein to a 20 per cent level by the use of "junk" feeds and comply in every particular with the statute and find a ready market. Such a feed has been sold in Massachusetts this season for about $10 a ton less than the price for dairy feeds consisting of material commonly accepted as high grade.

We may in the next decade see decided changes in feeding stuffs legislation. It may be that the incorporation into statute of labeling requirements covering all of the requisites of suitable special purpose feeds as scientific discoveries pile up will make laws complicated and unwieldy. Perhaps we shall come to feeding stuffs laws which will allow the manufacturer to state what he likes about the feed to which the label is attached and leave it up to the feed control official to prove the truth of the assertion, which, in effect, is identical with the Federal Food and Drugs Act.

The feeder should satisfy himself as to the integrity of the manufacturers who make the products he uses. Many of them maintain experimental plants and laboratories on a par with those of the state experiment stations. Others use to the fullest extent the resources of state and federal departments as a basis for formulating rations. A few get by on the basis of fancy advertising. The retailer who installs a batch mixer and makes a line of feeds, granting that he may be honest in his endeavors, in my opinion is seriously handicapped both in obtaining satisfactory ingredients and in the knowledge of how to mix them properly.

I often think the value of a feed is in inverse proportion to the "ballyhoo" used in advertising. A sane and conservative statement relating to a feed is a better criterion for judging its value than fine words.

# A Concrete Feeding Floor

Condensed from The Southern Planter

*G. B. Hanson*

WITH a better understanding of the value of a concrete feeding floor, cattle feeders everywhere are paving their feeding lots to keep valuable cattle out of the mud.

Many cattle feeders who have specialized in profitable beef production report that they wouldn't want to feed cattle without a hard surfaced feed lot. Agricultural colleges in states where beef production is an important business have made a very careful study to see what feeding practices and equipment are helpful in making profitable beef. These authorities, as well as many prominent and successful feeders, claim that the concrete feeding floor is a necessary part of cattle feeding equipment and second in importance only to the silo. It has been authoritatively said that a concrete pavement for the cattle feeding lot is worth $7 a head each year. At this rate many feeders figure that the floor will more than repay its cost the first year after it is built.

Three important savings in production costs have convinced many feeders that, concrete feeding floor increases their margin of profit considerably. These savings are: First, a saving in feed since no feed can be trampled down into the mud where it is lost to the cattle. In the second place, a concrete floor saves greatly on bedding which is on many farms a very important item; the third saving of importance is on the labor required to feed and care for the cattle. Feeding and tending to cattle when the feed lot is knee-deep in mud is neither profitable nor a pleasant chore. An inexpensive concrete floor will remedy this situation and provide a clean, hard surface that dries out within a few hours after a rain.

Not only are these direct savings made with a concrete floor, but there are also other savings of considerable importance. One of these is that where the practice is to have hogs follow the cattle on the feeding floor, there is practically no loss in feed and it is conservatively estimated that hogs will make sufficient gains to show an additional gain of $2 per head for each steer being fed.

Another factor which is becoming of ever-increasing importance is that manure can be recovered

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with very small losses, when the feeder keeps his cattle on a hard surfaced feeding lot. Farm land on which crops are rotated and which is favored with the return of the manure to the soil will continue to be productive for many generations.

Since an important part of the cost of feeding cattle is for labor of feeding and tending the animals, it is obvious that the paved lot should be located so as to make the most efficient feeding arrangements possible. The lot should be convenient to feed and water, and easy entrance to the lot with vehicles should be provided. The lot should also be in a sheltered location—if possible on the south side of some protecting building or other shelter.

The size of floor to build will depend upon individual requirements and the amount that is convenient to build at one time. If the entire lot cannot be paved at one time, a strip of concrete 20 feet wide in front of the barn is most desirable and this much, when completed, will be a tremendous improvement over the unpaved lot. Feeders usually build 30 to 40 square feet of floor per head.

Materials required per head and per 100 square feet of feeding floor 4 inches thick will be as follows:

Per Head

2.5 sacks of cement.
0.22 cubic yards sand.
0.28 cubic yards gravel.

Per 100 Square Feet of Floor

7.6 sacks of cement.
0.65 cubic yards sand.
0.85 cubic yards gravel.

After the size and location of the lot have been decided upon, the floor area is staked out and leveled in preparation for laying the floor. If it is necessary to place the lot in a poorly drained location, it will be best to make a well-tampered fill of about 8 inches of gravel, cinder or similar material and this fill should be above the natural ground level. If the lot is located on fairly well-drained soil, it is not necessary to place a fill under the concrete floor.

Most feeders find that a 4-inch to 5-inch floor of good concrete is sufficient and for good drainage the floor is given a slope of about ¼ inch per foot. 2 x 4 or 2 x 6 lumber may be used for forms and it is customary to build the floor in sections about 10 feet square. Many feeders also like to build a low curb around the floor and an apron or cut-off wall extending down into the ground about 1½ to 2 feet is found desirable. This apron or cut-off wall has several distinct advantages in that it prevents undermining of the floor due to rooting of hogs or erosion by run-off water. It also strengthens the edge of the floor, preventing

damage where heavy wagons or other vehicles must be driven across the pavement.

A concrete feeding floor is not only a profitable piece of equipment, but it is very easy to build and inexpensive. If good sand and gravel can be obtained on or near the farm, fourfifths of the material in the concrete is available with no cash outlay. Bank-run gravel should, however, be used with care. Best practice is to wash bank-run gravel to make sure it is free from silt, clay or other harmful materials. For best results, it should be screened into two different sizes of material. The fine material, or sand, should be well graded with different sizes up to ¼ inch in diameter. The gravel should grade from this size up to 1½ inch in diameter.

One of the most important factors in securing a concrete floor of good quality is to make sure that the mixing water is carefully measured and too much water must not be used. A good floor should be made of a concrete mix of the following proportions: 1 sack of cement; 2¼ cubic feet of sand; 3 cubic feet of gravel, with about 5 gallons of water added per sack of cement if the sand is of average moisture content. These materials should be measured carefully and mixed thoroughly to insure uniformly good concrete.

If water comes to the top as the mix is worked into place and leveled off, it is a sign that too much water is being used and, therefore, the amount of water should be decreased in the following batches.

The surface of the feeding floor should be left a little rough or gritty so that a non-slippery surface will result. To accomplish this, use a wood float for finishing. The concrete should be allowed to cure in a warm, moist condition for a minimum of one week. A good practice is to cover the new concrete surface with either straw, earth or a canvas cover and keep this covering sprinkled with water so that the concrete is prevented from drying out rapidly. The floor will be sufficiently hard in 10 days so that cattle may be placed on it, but heavy vehicles should not be driven across the floor until it has cured for three or four weeks.

Building a concrete feeding floor is an interesting and profitable job. It will give a lifetime of trouble-free service and will help increase your livestock feeding profits every year.

# The Plant—"The Medium of Nutrition"

**Condensed from Certified Milk**

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A "MEDIUM" is defined as "a substance through which a force acts." In the feeding of dairy cattle, the plant as a whole is considered the medium of nutrition. This medium is activated not only by its own physiological forces but by those of the soil, water, air and sunlight.

In the normal growth of a plant in any definite region, we may assume for the most part that water, air and sunlight are fairly constant factors. As constants they exert approximately the same force on plants within fairly definite climatic zones. The utilization of these forces by the plants of different species, however, is not constant, but determined for the most part by the genetics of the species.

The most variable forces acting on an individual plant, aside from genetic factors, are the ones within the soil. These forces are determined by the origin of the soil, the state of decomposition, the arrangement of the soil particles, the soil bacteria, the humus content, chemical composition and the availability of the soil nutrients.

The combination of all these forces produces the plants, which we as dairymen consider as so much protein, nitrogen free extract, fibre, fat, ash and dry matter for the compounding of rations to grow our animals and for the production of milk. A better understanding of the effect of these forces on the plant and also of the reaction of the plant species to these forces may be manifested by an improvement in the health of our herds, their reproduction and the production of milk of the highest possible quality.

Let us examine two of the best known hays or forage plants to see their variation in composition, these variations being controlled by species and other forces.

Alfalfa hay varies in crude protein content from 12.8 to 19.0 per cent, while timothy hay varies from 5.2 to 10.1 per cent. The higher protein values are obtained from both these crops by harvesting them at the cor-

**Reprinted by permission from Certified Milk, New York City**

rect stage of maturity. In the case of alfalfa that means cutting at the pre-bloom stage, while the timothy must be harvested as the heads are coming out of the sheath.

From experimental results in manuscript at the New Jersey Agricultural Experiment Station, the protein values of immature timothy hay as well as total yields of the crop have been increased to a marked extent by heavy nitrogen applications to the sods early in Spring. Further experimental results in manuscript form at this Station show that soluble nitrogen applied to timothy two weeks before harvest raised the protein content to 11 per cent in the dry matter. This nitrogen force was captured in the plant and held for animal nutrition before the plant could dissipate it in additional growth before maturity.

It must be realized, however, that the total protein in the plant is not the solution of the protein problem in nutrition. The chief protein in a plant may have an entirely different amino acid composition from the protein in another plant. As early as 1864, Wolff calculated the amount of digestible crude protein he deemed necessary for various classes of livestock. Later investigators have shown that the quality or kind of protein may be as important as the amount.

The proteins are extremely complex substances. The digestion of these proteins within the body cause their cleavage into amino acids. As far as we know, there are 22 or more of these acids. The body is able to make some of the more simple ones; others cannot be synthesized. The ones which the body is unable to synthesize according to experimental tests on rats, are—lysine, cystine, phenylalanine, leucine, isoleucine and histidine. Some plant proteins in a particular ration can only furnish 20 per cent of a certain essential amino acid for growth. If this plant were used as a sole source of protein, the protein intake of the animal would have to be raised to five times the calculated requirement to produce normal growth.

The knowledge of the proteins and amino acid content of plants is incomplete at the present time. Continued investigations are bringing to light new information regarding them. Of this one fact we are almost certain. There will be no protein deficiency if the ration of a dairy cow is made from a variety of plant sources. This is assuming a total protein intake for the animal which meets the calculated requirements. These requirements are approximately .7 of a pound for the maintenance of a 1000 pound cow and .05 of a pound

for each pound of 4 per cent milk produced. It is doubtful whether the kind of protein in a plant can be changed but the amount of protein can be increased or decreased by forces either within the soil nutrition or in the hands of the operator.

Let us examine the nitrogen free extract composition of these two plants. This extract in the usual chemical analysis of feeding stuffs contains the sugars and starches as well as the more soluble parts of the celluloses and pentosans, including the hemicelluloses. Alfalfa hay averages 36 per cent while timothy contains 45 per cent. This extract of the plant is readily converted into energy when taken into the system of the cow. This content of the plant is not readily controlled by any forces except the inherited ones and those of maturity.

Both plants have approximately the same content of crude fiber. This compound gives bulk to a ration but is incompletely digested. The forces controlling this factor are mainly heredity and maturity. The greatest control may be exerted on alfalfa which varies between 22 and 36 per cent in fiber by early harvesting.

The fat content of all forage plants is low. As far as we know this also is controlled by heredity and maturity. It is true that milk fat and body fat can be formed by a lactating animal from proteins and carbohydrates. However, Maynard and McCoy, of Cornell, found that the yield of milk and butterfat is decidedly decreased when roughages are not supplemented with a grain ration consisting of plant seed products averaging about 4 per cent fat.

Of all the forces acting on the plants the greatest variable is found in the minerals. It has been known for many years that minerals are necessary to the health of animals and even for life itself. The discovery of mineral deficiency diseases and their prevention are of comparatively recent origin. Plants grown on soils of great natural fertility in all respects reflect the forces qualitatively and quantitatively. Animals fed on these plants suffer no disturbances from mineral deficiencies. Let us look at the other picture. When the stores of raw materials in the soils have been diminished by over grazing, soil robbing cultural practices and erosion, the plants grown on these soils become deficient in certain minerals. When the animals are grazed on these plants or are fed combinations of hay and grains produced on these soils, mineral deficiency diseases become manifest. In all probability before mineral deficiency diseases become manifest by outward symptoms, physiological

disturbances have been occurring in the animal. This can easily be understood if we partly analyze the mineral problem in animal nutrition. A few examples to show their importance are as follows: The skeleton is nearly all calcium and phosphorus. Phosphorus is vital to the proteins in the nuclei of body proteins, the phospho lipids in protoplasm and milk casein. Iron is necessary for hemoglobin. The acidity or alkalinity of the digestive juices are due to mineral compounds. Osmotic pressure for interchange of nutrients and waste products depend on mineral concentration. An insufficiency of minerals in plants may upset normal body functions when these plants are fed. This may reduce breeding efficiency in our livestock, may make the animals more susceptible to disease, at least may reduce their efficiency to the point where they are no longer profitable.

The calcium content of different plant species may vary normally from .1 to 1.59 per cent while phosphorus may vary from .08 to .33 per cent. Under abnormal soil conditions the content of these minerals may be reduced 60-70 per cent. In other cases the soils may be so acid or lacking in available calcium that rich calcium feeds such as legumes will be unable to exist. In other soils, if the relationship between phosphorus and potash is upset there may be a decrease in the clover population. A decrease in clover population prevents the fixation of nitrate nitrogen by bacteria in nodules on the roots of these legumes. This affects the growth of natural grasses growing in association with the legumes. Ohio experiments carried out over several years showed that timothy grown with legumes yielded over 40 per cent more hay than timothy grown alone. The percentage of protein in timothy was 44 to 50 per cent higher when grown with alfalfa than when grown alone.

Legume forages are rich in calcium, while the grasses are low in this same element. Both legumes and grasses are low in phosphorus when harvested at maturity. In the immature stage or at the pasture stage on fertile soils, both the legumes and grasses have larger percentages of phosphorus.

Whether the mineral content of a plant is 1 or 10 per cent, serious deficiences in the soil of essential mineral elements are reflected in the plant and through the plant to the animal. A lack of iron in the plant causes "Salt Sick." Lack of iodine causes goiter; a lack of phosphorus produces "Creeps or Pria"; a lack of calcium or phosphorus or the wrong balance between them in the absence of vitamin D, pro-

duces rickets. Although sulfur, potassium, magnesium, copper, manganese and zinc are essential to life or growth, a sufficient amount of these elements in the soil will produce a herbage which will take care of the normal needs of our cattle.

Discoveries of vitamins and their import in the field of nutrition have had a profound effect upon the dairy industry. Some of the effects of these vitamins on animal well-being are common knowledge. Continued research will add to this knowledge and will help in the solution of additional nutritive problems. The plant as the "medium of nutrition" either in the green or dry stage, or the seeds produced by these plants, is the greatest common source of vitamins. Green hay and forage plants are an excellent source of vitamin A. These same plants made into hay of good quality contain large amounts of vitamin A although there is a considerable loss in storage. Hays and green stuff contain an appreciable amount of vitamin B. Green roughages are a potent source of C, while this vitamin is entirely lacking in the hays from these crops. Well cured legumes are a good source of vitamins A, E and G, although D is lacking in the green roughages.

The relationship between the vitamins and the soil nutrients is not clearly understod but it is possible that manganese, boron, copper and zinc may interfere with the normal production of some of the vitamins.

The plant as the "Medium of Nutrition" is a dietary tool made more or less perfect by the combined forces within the air, soil, water and sunlight. A lack of some of these forces or an overabundance of others effects the potency of this medium. With the exception of common salt our herbiverous animals can receive a perfect ration, balanced in all respects as far as our knowledge now goes from the plant or plant sources. However, these animals in addition should have access to good water, fresh air and sunshine.

We must direct our investigations not only to rebalancing the soil nutrients to make the plant a perfect medium, but we must also investigate the methods of preserving plants and plant by-products so that losses in nutrients may be minimized. This is important both from the standpoint of growing dairy animals and producing milk, the most perfect food for human consumption.

Let us examine the perfect ration for the dairy animal.

The dry cow has been turned to pasture in June to re-build her body after a strenuous year's work. This pasture consists of a

variety of grasses in abundance grown on a soil that has been well limed and fertilized. The mineral content of these immature grasses is high and the protein content is balanced because of the variety of plant sources. This is essential because this dry cow must not only re-build her body for another strenuous year's work, but must produce a strong calf by late August or September. The mineral and protein needs of this developing calf are varied and important. After the birth of this calf she receives the milk from her dam and other foster mothers for varying periods. Until she is nine or ten months-of-age normal healthy growth is continued by feeding well preserved roughages and grains. At ten months-of-age she is turned to good fertilized pasture which furnishes a variety of proteins and minerals; the herbage is succulent and palatable; the vitamin content is high. This environment produces normal healthy growth and builds a strong healthy body. In the Fall she is stabled and fed silage which has been made from grasses and hay produced from these well nourished soils. She is bred to prepare her for her life of usefulness when she is 18 months-of-age. Following the Winter sojourn, she is again turned out to pasture and the plants complete their function by producing a well developed fresh two-year-old heifer ready to do her share in furnishing food from plant and plant products.

# Infectious Bronchitis

Condensed from Poultry Tribune

*Dr. J. R. Beach*
University of California

INFECTIOUS bronchitis of chicks was first recognized and described as "an apparently new respiratory disease of chicks" in 1931.

It quickly became widely distributed, particularly in central-western states, and, since it was seen principally in hatchery-produced chicks, appeared to be a hatchery-spread disease. The symptoms of this disease so closely resemble those of infectious laryngotracheitis (formerly termed infectious bronchitis) of older fowl that in sections where both were present, they were not differentiated, and the disease under discussion was looked upon as infectious laryngotracheitis in chicks. The occurrence, later, of laryngotracheitis in fowls which had been affected with chick bronchitis during chickhood made it appear that fowls might have laryngotracheitis more than once, although all experimental evidence indicated that this could not be the case.

This confused situation was cleared up when it was shown that the causative agent of chick bronchitis is quite distinct from that of infectious laryngotracheitis and, therfore, that the diseases are distinct.

Chick bronchitis is caused by a member of the group of disease-producing agents known as filterable viruses. *Damp, draughty, or poorly ventilated brooding rooms cannot produce the disease, but, under such conditions, the symptoms would be more aggravated.* The virus is found principally in the mucus exudate which collects in various portions of the respiratory tract of affected chicks. It is by means of this mucus that the disease is transmitted, either by direct contact between diseased and healthy chicks or through litter, chick boxes, equipment, clothing of attendants, etc., that has been contaminated with mucus from diseased chicks. The origin of the infection in hatcheries and on many farms cannot be determined in many instances.

In the case of an outbreak in a large broiler plant, however, it was directly traceable to an attendant who had infected chicks at home and had been "experimenting" with "cures" for them.

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A good portion of the disease on farms has been in chicks coming from infected hatcheries. The hatcheries which became infected have, for the most part, been those which dealt in chicks held for one or two weeks in batteries before sale (started chicks) as well as in day-olds. The disease, in such cases, has been present at the hatcheries in the "started chicks." The day-olds would pick up the infection either before leaving the hatchery or from contamination in the boxes in which delivery was made, but would not develop symptoms until they had been in the brooder on the farm for a few days. In case the disease was mild or did not progress rapidly through the brood, it might escape notice until the second or third week.

The disease usually spreads very rapidly through a flock and infects up to 75 per cent or more of the chicks. In the earlier reports, it was stated that from 40 to 90 per cent of infected chicks died. In the writer's experience, however, the mortality from outbreaks has usually not been more than 10 per cent, and, in a number of instances, the chicks have been so slightly affected that the loss by death was negligible. In one outbreak in a large plant, for example, the mortality was 3 percent of 2,000 Leghorns, 9 percent of 2,000 Rhode Island Reds, 12 percent of 500 Barred Rocks.

The disease has occurred most frequently in chicks from three or four days to three weeks of age, the first cases being recognized in most instances when the chicks were from five to ten days old. It has been seen occasionally, however, in chicks a month or more old and, in laboratory tests, chickens up to four months of age were found to contract the disease as readily as younger ones. Although outbreaks among half-grown or mature chickens have not been observed, there is at present no reason to believe that such older chickens would not become infected if they were exposed to the disease and had not been infected when they were younger.

*Gasping* is the symptom most characteristic of the disease and most commonly exhibited by affected chicks. The chicks stand with the head extended forward and upward and open the beak wide at each attempt to breath inward. The gasping may be almost a continuous procedure or may be intermittent. Coughing is sometimes seen, but this is not a prominent or constant symptom.

The gasping is usually not accompanied by any noticeable sound, but when affected chicks are held close to the ear, a peculiar crackling sound can be heard at each breath. There may be an involvement of the nasal pas-

sages of the head causing a discharge from the nostrils and swelling of a side of the face beneath the eye as is seen in chickens with ordinary colds.

In one natural outbreak that was studied, nasal discharge and swelling of the face were the predominant symptoms, and it has occurred as often as the gasping symptoms in chicks which were infected by inoculation with exudate.

Severely affected chicks are listless and droopy; the more mildly affected ones, however, remain active and, aside from the gasping, are normal appearing. An attack of the disease may cause the death of 10 percent or more of the chicks, or it may pass through a flock without causing hardly any loss. The course is usually very rapid and the flock is back to normal appearance in about a week.

At post-morten examination, the cause of the gasping is found to be thick, yellow mucus in the lower part of the trachea and in the large bronchial tubes. In cases of a few days' standing, the exudate may be found to be partially cheesy or to have formed a cheesy plug in the trachea and bronchial tubes, or sometimes in the larynx. Death occurs when the accumulation of mucus exudate in the trachea or bronchial tubes prevents the chick from getting enough air. When the nasal passages are involved, thick yellow mucus, which is sometimes cheesy, will be found there. The earlier description of the disease stated that congestion of all or a portion of both lungs was a constant post-mortem finding, but this has not been observed by the writer.

Infectious laryngotracheitis is the only disease of chickens which resembles chick bronchitis closely enough to make it difficult to distinguish between the two. A particular differential feature is the age of the chickens affected, since chick bronchitis usually is seen in chicks less than a month old, and it is unusual for chicken under three or four months of age to become affected with infectious laryngotracheitis.

Another aid in identifying the disease would be learning whether chicks from the same hatchery on other farms were also affected. If such were the case, the disease would probably be chick bronchitis. Distinguishing chick bronchitis with certainty would be particularly difficult when infectious laryngotracheitis had regularly occurred in older chickens on the farm. In such cases, it would be well to seek information from the veterinary department of the agricultural experiment station, and test inoculations might be necessary to arrive at a diagnosis.

Outbreaks of chick bronchitis

in which nasal discharge and swelling of the face were predominant manifestations could be distinguished from a common cold by the fact that many of the affected chicks would also show the characteristic gasping symptom. Brooder pneumonia, due to mould (aspergillosis) or other types of infection, differs from chick bronchitis in that gasping would not be so prominent in affected chicks, listlessness and droopiness would be more prominent, the loss by death would likely be greater, and, at postmortem, there would be found involvement of the lungs, and, perhaps, also the air sacs, but little, if any, accumulation of mucus exudate in the trachea. In the latter case, however, it would be wise for the poultry owner to have chicks examined by the veterinarian at his experiment station, or other competent person, rather than to rely upon his own judgment.

There is no effective treatment for chick bronchitis, either for individuals or for the flock, as a whole, and the use of alleged remedies is, therefore, merely a waste of money. The most that can be done is to keep the chicks in roomy, dry, warm, well-ventilated, comfortable quarters and not allow them to crowd.

The prevention of the recurrence of chick bronchitis after its first appearance on a farm has not been difficult, as a rule, in case chicks are brooded only during a few months of the year and the brooder houses and equipment are unused the rest of the time. In most cases, a thorough cleaning and disinfection of the brooders and the few months of idleness have rendered them safe for use again the next year. The most certain way to avoid bringing the disease onto a farm is to obtain chicks from hatcheries which handle only day-old chicks, or, if purchases are made from a hatchery which handles "started chicks" to make sure that the disease is not present or has not recently occurred among the "started chicks" there.

When the disease gains entrance to a farm, broiler plant, hatchery or other establishment, where the brooding of chicks is more or less continuous throughout the year, its eradication presents a more difficult problem. It usually will require that brooding operations be suspended long enough so that all rooms, pens, batteries and equipment can be completely emptied of chicks. Everything is then very thoroughly cleaned and disinfected and given a period of idleness before brooding is resumed. It is a wise precaution for hatcheries which sell started chicks, or for any other reason brood as well as hatch chicks, to have the space for brooding completely sepa-

rated from the hatchery and the rooms in which day-old chicks are handled, and, if possible, not to have the brooding and hatchery operations carried on by the same persons.

It has been reported that chickens could be immunized against chick bronchitis by the cloacal vaccination method, as is successfully used for infectious laryngotracheitis and which consists in the application of exudate from the trachea of infected chickens to the mucus membrane of the vent of healthy chickens. In a limited number of trials which the writer has made, however, the application of chick bronchitis virus to the cloaca invariably caused infection of the respiratory tract, as well as a local reaction in the cloaca. However, even if successful, this method would be of doubtful practical value because of the difficulty in applying it to chicks under a month old.

# Selecting Feeder Steers

Condensed from The Hereford Journal

*Ralph McCall*

Animal Husbandry Department, Montana State College

THE grower of feeder cattle as well as the cattle feeder is interested in producing fast gains economically on animals that will bring a satisfactory net return. The feeder buyer recognizes certain qualities in a feeder steer which indicate that he will gain rapidly and command a good price when finished. He attempts to buy steers possessing as many of these qualities as possible for the money.

The first thing many buyers look for is a good head, that is, one that is short and broad throughout, particularly at the muzzle. If given a choice of seeing only the feeder's head or the rest of his body, many buyers would choose the former because body conformation can change for the worse materially during the feeding process but this seldom happens to a feeder with a good head.

A good head is by no means an infallible indication of a good feeder, but its "batting average" is quite high. Usually a feeder with a short broad head is broad and compact in body, and a

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broad muzzle indicates ability to consume a large quantity of feed, which is necessary to produce fast gains. An alert and prominent eye is desirable, but a "wild" eye is decidedly undesirable. A steer that heads for the farthest corner of the lot at every unusual sound seldom makes an economical gain.

A good feeder should have a broad, deep body with moderately heavy bone, indicating ability to make rapid gains. Although the packer buyer prefers rather fine bone, a fine-boned steer usually will not gain as fast as one with moderately heavy bone. The neck should be short and moderately thick but no indication of stagginess. The top line and underline should be straight, with full flanks. The body should be moderate in length from the shoulders to the hooks, giving strength, width and thickness to the back and loin. The rump should be long, level and uniform in width.

The quarter should carry down full to the hock, and the twist should be low. Indications of quality are smoothly blended shoulders, both in front and behind, smoothly covered hooks, smoothness at the tail head, clean leg joints, trimness of throat, brisket and middle, smoothness and evenness of fleshing and a sappy, mellow hide. It is particularly important for long-fed steers to possess quality.

A glossy coat of hair and an alert eye indicate a healthy feeder. A stunted steer, or one that is not healthy seldom returns a profit unless purchased very cheaply. A slick-haired steer looks out of place with a group of curly-haired steers. Size for age is also very important, indicating what may follow. A big, upstanding steer seldom tops a market, but a very typey-looking steer that is not a fast gainer is seldom very profitable.

A color typical of one of the beef breeds is very desirable. A uniformly good color is necessary in a group of feeder steers in order to present an attractive appearance at the market. Uniformity of type, age and size are also very important from the standpoint of feeding, time of finishing and market appearance. It is sometimes economically desirable for the feeder to buy a mixed group and separate them in the feedlot according to age, grade and sex if he is equipped to do this. Steers of the same breeding usually fatten more uniformly and do better together than those from several different places which are fed together.

There are a number of other things to consider in selecting feeder steers. One of the most important is the type and amount of feed available. If it consists largely of hay, other roughage,

or coarse, poor quality feeds of most kinds, it would be folly to try to fatten young cattle. On the other hand, if the amount of roughage is limited and grain is plentiful, feeder calves have an advantage. If the amount of feed is limited, usually fleshy feeders are safer. If it seems desirable to put a high finish on the steers, one should start with steers of good quality, as it is impossible under ordinary conditions to realize a margin great enough to pay for the high finish on low-grade steers.

If all indications point to a rising market, heavy feeders are more desirable because of the increase in value of the original weight. Less margin is needed to make money when the price of finished cattle is high and the price of feed is proportional to the price of cattle. If feed prices are quite high with little prospect of a general rise in the fat cattle market, younger cattle which gain more economically are the best bet. The proportion of light and heavy cattle on feed is a very important point to consider. If the market is quite uncertain with a probable low point at normal marketing time, feeder calves are safer, because they can be carried on for some time and still make economical gains and in addition still sell at handy market weights.

It is often to the feeder's advantage to buy a mixed group of heifers and steers, as he can usually buy such a group cheaper than if the heifers and steers were bought separately. They should be separated at the feedlot for best results. Heifers do not make as rapid gains as steers, but fatten more quickly. Ordinarily the spread between good quality fat heifers and steers weighing less than 800 pounds is not very great, but widens above this weight. Feeder cattle are usually cheapest in the fall but high quality fed cattle usually sell highest in late summer and early fall. Low grade cattle should be marketed in the spring or early summer.

The old saying, well bought is half sold, is still very true. The best feeder cannot make a profit on a group of feeder steers, even though they are fancy feeders, if he pays more than that quality of feeder warrants unless fate steps in in the form of an unusual rise in the market. It is also very true that feeders purchased at less than the going price for the particular grade can lose money due to inefficient feeding even though the market remains normal; and finally, neither shrewd buying nor economical feeding avail much if the steers are not marketed right.

# There's Money in Meteorites

Condensed from The Western Farm Life

*Frank Clay Cross*
Colorado Museum of Natural History

MANY of the most important discoveries of modern times have been made by farmers; discoveries which have broadened our knowledge of the origin of mankind, and of how men lived before the dawn of history; discoveries which have helped to clear away the mists obscuring the dim vistas of the past, when dinosaurs inhabited the earth; discoveries which have thrown new light on many mysteries of creation. No layman has done more to extend the frontiers of science than the farmer with his plow, and plenty of farmers have been well rewarded—in a financial way—for what they have discovered. It pays to keep your eyes open.

Maybe you've made an important discovery yourself. How about those arrowheads laid away on the top shelf in your pantry? How about those bones which you saw cropping from the soil of a side hill, several months ago, when you were rounding up your cattle? How about that queer stone which you plowed up last spring? You may be overlooking an important discovery—one that would put money in your pocket.

An ordinary arrowhead has no special significance, and little value, but look through your collection again. You may find a Folsom point in it. These popular spearpoints, which are much more valuable than ordinary spearpoints, were made by the earliest known inhabitants of North America.

Thousands of years ago, when our continent was roamed by great mammoths and mastodons and other strange creatures of prehistoric times, Folsom man lived and hunted them. Mainly, he appears to have inhabited the region just east of the Rocky Mountains, as far north as Wyoming; but now and then his spearpoints are found in other parts of the country.

Scientists are especially interested in specimens from Idaho and Montana, and from any part of the region west of the Continental Divide, for they believe that the first Americans came from Asia across the Bering sea. Thence, if the theory is correct, they migrated southward through

Reprinted by permission from The Western Farm Life, Denver, Colorado

the mountains, spreading later toward the east. The Rocky Mountain farmer, more than anybody else, can help to prove whether or not Folsom man actually came along that route.

If you have found a Folsom point, or even a fragment of one of them, you should report it by all means, even though you do not wish to sell it. These spearpoints are easy to identify. They always have a wide, shallow groove on each side of them, extending from the base toward the point.

Perhaps you may even find a Folsom campsite, such as was found in northern Colorado several years ago. Search along the bottoms of little gullies, or arroyas. If you should come across a Folsom point in one of them, look for more, or for pieces of chipped flint, toward the upper end of the arroya. Search the banks carefully on both sides. You may see another spearpoint, or a fragment of flint, sticking from the soil. There may be your Folsom campsite, buried in the ground. If you should have such luck, report your discovery at once to some museum.

Likewise, be on the lookout especially for any Folsom point with bones nearby. They may be bones of some prehistoric animal killed by a Folsom hunter, or the bones of the hunter himself. Any human bones buried deeply in the ground are always of great archaeological interest. These finds should never be disturbed. Leave the bones, and the spearpoint, too, if one should be there, right where you find them, until some expert has examined them. To disturb them would probably be to ruin the value of your find completely.

If you know the whereabouts of any pictures carved in the rocks by the Indians near your home, examine them carefully. If you should see a picture that looks like an elephant, report it to some museum by all means. Such finds are of particular interest to the scientist. There is also money to be had from other Indian relics such as you may plow from your fields, or find in your rides across the range. Museums are always eager to see the more unusual things, and collectors are eager to get relics of any kind.

Fossil plants, fossil shells, fossil insects, and the bones of prehistoric animals are often salable. Be on the lookout, especially for fossil footprints. They are usually very valuable. If you should stumble upon a human footprint in the sandstone, you'll have one of the most spectacular discoveries ever made to your credit. Such footprints have often been reported, but none of them, thus far, have ever proved to be authentic.

The Rocky Mountain region is the richest fossil field in North America. Here are found the bones of dinosaurs, the bones of those great rhinoceros-like animals, called titanotheres, and many other monsters of the past. Do not look just for large bones, however; look for small ones, too. There are some small fossil bones which are even more valuable than the larger ones.

Indian relics and fossils are easy to recognize. Your important discovery, however, may be neither of these. You may have thought it to be just a worthless stone which got in the way of your plowshare. Look at it again. You may have found a meteorite—one of those strange missiles that hurtle down to earth from the sky. Meteorites are always of scientific interest, and the farmer who finds one may be sure of getting a good price for it. Few states in the union have produced more of them than Colorado, and every other mountain state has yielded one or more of them.

There are several kinds of meteorites. The easiest kind to recognize is the iron variety. If you should find a piece of iron which does not appear to be of artificial origin, examine it closely. Notice the shape of it. Most meteorites have very irregular shapes. If your specimen is round like a ball, or flat on one side, it is probably no good. Notice the surface of it.

The surfaces of meteorites often look a good deal like the crust of whole-wheat bread. Sometimes, however, they are covered with little pits, as if a match head had been dabbed in them while they were still soft. If your specimen has deep holes in it, the chances are that it is simply a piece of bog iron, or slag. Remember, too, that meteorites are never hollow inside.

Stony meteorites are harder to distinguish. On the outside they usually look a good deal like the irons. If they are newly fallen, they will be black on the surface, and sometimes you'll see little threadlike lines on them, where the molten material has streamed over them as they flamed through the atmosphere. If they are old falls, however, they will be rusty brown.

On the inside, if you break them open, you may find them to be almost any color from gray, or brown, to almost black.

Most meteorites are hard to break. There are several extremely rare and valuable types, however, which may be crumbled between the thumb and finger. These easily breakable meteorites may usually be identified by the presence of little round balls in them, ranging from the size of peas to the size of walnuts. Sometimes these balls are made

of glass-like material, usually dark in color; but others look much like colored putty with sand grains mixed in them. Several months ago a farmer in Minnesota sent me such a specimen. It was vivid green—the most remarkable meteorite ever discovered.

There is probably not an area 10 miles square anywhere on the land surface of the earth, according to the best authorities, where at least one meteorite is not waiting to be found. Yet it does little good to hunt for them, for the most of them are buried in the soil where they are discovered, just accidentally, by farmers working in their fields.

You may find one, however, which has been weathered from the soil by wind and rain, in your rides across the range. If you should come across any very queer stone, you should send a specimen of it to some expert on meteorites for an examination. It might be worth as much as several hundred dollars to you. Look at your specimen carefully, however, before you bother anybody with it. Be sure that it is really different from ordinary stones.

# Turning Sorghums into Income

Condensed from Kansas Farmer

*Tudor Charles*

A variety of grain and forage crops is ideal, but no plant comes thru in the short feed years as well as carefully handled sorghums.

More farmers than ever before now have grain and forage from the sorghums. Many of them are undecided just how to convert these crops into livable income. When we consider living first, the poultry flock comes to the front. These fields of kafir and milo will make fine feed for pullets and hens.

There are two principal ways to feed kafir or milo to hens, in the head or threshed. The threshed grain will serve in the whole grain ration or in the mash. From the economy standpoint, sorghum heads may be fed very cheaply, altho they won't make up a balanced ration by any means. At any rate, the farm family which has a good flock of layers, and a field of grain sorghum, has a combination that can turn out the cash very satisfactorily.

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Dairying stands high this winter in the list of favorable means of utilizing sorghums. This holds true for both the grain and the fodder. Farmers who already have their crop in the silo have taken the safest means of getting full value as a feed for dairy cows.

But many farmers, for one reason and another, have not been able to convert their sorghums into silage. Huge fields of shocked feed over the country bear proof there is plenty of sorghum that will have to be fed dry. This means that for dairy cattle, grinding the fodder in roughage mills will be the economical way of using it. In many cases this will fit the needs of farmers better than silage, for they will be able to prepare the feed as they go along, without any extra outlay for labor.

In many cases, feed grinding will make the crop go twice as far, and when the crop is short this item is important. Over a period of years, very few farmers will make a mistake in buying a roughage cutter to handle their feed. It will be an investment that will pay back every year more than the cost of the carrying charge. This year when dairy cattle promise to give a better return than meat-producing animals, is a good time to start the practice of converting dry roughage into a feed as near like silage as possible. If the sorghum is well headed, a mill which will grind the grain and pulverize or chop the stalks, will make a feed that is rich in both grain and bulk.

In considering the grain of sorghums alone, hogs come to the front. Sorghum heads may be fed just as they come from the bundle without much waste. In fact this is considered just as economical as threshing and grinding, altho the latter method will make the grain go much farther. Which way to feed would depend largely on whether a farmer has the equipment and time, to thresh and grind the grain without much cost.

It is likely that if hogs eat large quantities of lower grade forage sorghum grain, such as cane seed, it may cause digestive disturbances. Quite often when cane seed is picked up by hogs around a silo or hay pile, the grain is musty or moldy and this would be injurious. But clean seed of the grain sorghums, fed regularly, is considered as safe as any other feed.

Next in line after poultry, hogs and dairy cattle, the wintering and feeding of breeding ewes and beef cows looks favorable. Profits from wintering steers or fattening lambs, for sale in the spring, are not promising. In other words, the farmer who is prepared to winter breeding stock

and carry them on thru the summer, can feel safer in doing so than the man who winters and fattens steers or lambs for the spring market. A new and bigger crop of fat livestock is coming to market in the first half of 1938. Furthermore, good feeders are selling high this fall. Fattening costs will have to be very low, markets specialists believe, to allow a profit for winter feeding ventures.

Next to breeding stock projects, the handling of choice calves, for summer grazing and feeding in the fall of 1938, looks best. After the big crop of finished cattle from the Corn Belt has run its course next year, fat yearlings have a good chance to pay well for wintering, grazing, and grain feeding. But it looks as if the project would have to run that long—12 to 14 months—to be safe.

An alternative for the man who feels he must winter larger cattle, and who can put them in slaughter flesh in the spring without heavy grain feeding, would be to plan on buying choice yearling steers next spring to graze and fatten for the late 1938 market.

It seems that livestock men who have good herds of beef cows or ewes to consume their sorghums are in a position to get the most out of their feed.

From a market viewpoint, storage of sorghums appears a safe way of handling the matter. In other words, roughage carried over until a year from now has a better chance of eventually turning into profit, than that fed this winter just for the sake of getting rid of it. Granting that the silo is the best place to store sorghum fodder over next summer, it is true that kafir or milo bundles can be handled with virtually no waste by stacking them carefully after they are dried out. Kafir or milo grain spoils easily, and only the driest grain will keep after warm spring weather comes, but in the stack, kafir and milo have been kept for years. The dry stalks protect the grain.

The sweet-stalked sorghums also can be stacked satisfactorily, if they have had an opportunity to cure well. In the shock, or in narrow ricks is the way most farmers prefer to cure them. In Western Kansas, fodder can be stacked during the late winter months and will likely keep well for a year or two.

# Pig Testing to Date

**Condensed from Farm Journal**

*E. L. Quaife*

**Iowa State College**

IT isn't altogether how much good feed a pig eats that makes him fat. It is to a considerable extent his inherent ability to turn the feed into pork —his "umph," if you want to call it that.

That seems a safe conclusion to draw after looking over the records of 1937 pig testing work in Iowa. These records represent accurate weighing and marking of 167 litters on 22 different farms.

Average weight of the 167 litters was 212.4 pounds at 56 days of age. The heaviest litter, ten Poland Chinas, weighed 552 pounds. On one farm were ten litters which averaged eight pigs that weighed 289 pounds per litter.

That was the best average for any one farm. Next best was 288 pounds on nine litters that averaged eight pigs. There were 53 of the 167 litters which averaged 250 pounds or better at 56 days. The lowest average per farm was 130 pounds per litter, on 15 litters that averaged 6.5 pigs at eight weeks.

An interesting story on size of litters is found in the 1937 records. Out of the 167 litters, there were 66 which averaged eight pigs or more per sow. Eight-pig litters numbered 25; nine-pig litters, 23; ten-pig litters, 11; eleven-pig litters, 10. There were five litters of 11 pigs each, two litters of 13 pigs each. Heaviest average weight per pig was in the ten-pig litters; next heaviest, in the seven-pig litters (35 in number).

The weights of 1937, as well as those of 1936, show that some strains are much better than others at converting feed into pork. This is in line with what has been found at Iowa Experiment Station, where some litters have put on 100 pounds of gain with 154 pounds less feed than other litters fed under similar conditions.

Just exactly how much of the pig's ability to make use of feed for rapid, economical gains can be attributed to his inheritance is rather difficult to ascertain. Experimental work in Iowa indicates that from 10% to 25% of

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such abiilty might be attributed to inheritance. The weighing of these litters on Iowa farms is intended to help swine raisers to learn more about this ability, about the value of strains.

It is possible, though one cannot say so too definitely, that inheritance may be of greater influence under general farm conditions than in carefully planned feeding trials. Certainly if as much as 25% of the efficiency of production is due to inheritance, every possible effort should be made to gain whatever advantage there may be from it, the same as is done by balancing ration or protecting the health of the pigs.

What it all comes down to is the keeping of records on individual litters — size of litter weaned, and weight of litter at a specified age, say 56 days. Then when it is time to select stock, the owner naturally saves the gilts of good type from the large, most rapid gaining litters. The next step is to secure a male from a large, thrifty litter to mate to these gilts.

A beginning along this line has been made in Minnesota as well as Iowa. Foreign countries (Denmark, Sweden, Holland, Switzerland, England, New Zealand) have been developing plans of this kind in the past few years.

A good mark for swine raisers to shoot at would be eight pigs per litter from older sows, seven per litter from gilts. As for weight, the goal might be 250 pounds per litter from the mature sow, 225 pounds from the gilt, at 56 days.

New Zealand, a country which has passed the trial stage with this plan, feels that 300 pounds of pig weight at 56 days should be obtained by the better producers. In fact, their records of 435 litters last year showed an average of just under eight pigs weaned per sow. The average weight per pig was 37.5 pounds and the weight per litter 295 pounds.

The data obtained in Iowa in 1936 indicated that Iowa swine producers have a long way to go to average 250 pounds of pork per sow at 56 days of age, whether it be due to feeding, lack of thrift, or ability on the part of pigs to make use of feed. This year's figures are more encouraging.

Of 106 litters weighed on 10 Iowa farms in 1936 there were only 18 litters which weighed 250 pounds or better in a 56 to 72 day age range. One litter of six pigs at 58 days weighed 247 pounds; another litter of six on the same farm weighed only 121 pounds at 58 days. Both litters were fed the same ration.

# Disease-Resistant Bees

**Condensed from Country Gentleman**

*Frank C. Pellett*

AMERICAN foul brood, a disease of young bees in the larval stage, is the most serious problem with which the hive owner has to deal. One after another of the states where beekeeping is important has made large appropriations in an effort to check the spread of this disorder.

For a number of years there has been an occasional report of a colony of bees which appeared to recover without outside assistance, but these instances received little credit. It was assumed that there must be a mistake in diagnosis, since authority continued to teach that, once a colony of bees became infected with American foul brood, recovery was impossible.

When reports of success with resistant stock in combating numerous plant diseases became increasingly common, however, it offered encouragement to the belief that there might be something to the claims of beekeepers who reported stock resistant to American foul brood. Accordingly, in the autumn of 1934, a co-operative experiment was planned to test the matter.

The co-operating agencies were the Iowa Agricultural Experiment Station, the extension service of Iowa State College of Agriculture and the American Bee Journal. An apiary was established at the writer's farm, Pellett Gardens, Atlantic, Iowa, with the writer as caretaker. The technical work was placed in the hands of Dr. O. W. Park, of the experiment station staff, who already had outstanding experimental results to his credit. The extension service was represented by Prof. F. B. Paddock, state apiarist, who gave special attention to a search for stock offering promise of resistance.

The problem was simplified by the fact that already several cases of apparent resistance were on record, and these gave a hint as to likely sources of stock.

No sooner had spring opened in 1935, than efforts were made to secure stock with a history which indicated disease resistance, from as many sources as possible. The response was favorable and stock came from many different places from Vermont to California.

In order to insure uniform

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conditions, each colony was built up to occupy eight or more frames of a modified Dadant hive. It was then inoculated by cutting out a rectangular portion of a comb in the middle of the brood nest. This piece, about two inches by two and a half inches, was replaced by a similar piece cut from a comb of a badly diseased colony and containing at least seventy-five scales of the disease. This was a far heavier inoculation than any colony would be likely to get in any normal exposure under natural conditions.

At the time of the test, bees of all three races: Italians, Carniolans and Caucasians, were in the yard. Final results found colonies which appeared to be resistant and others highly susceptible in all three races.

During the first summer twenty-five colonies with a history indicating possible resistance, and six check colonies were put to the test. There was a great difference in the behavior of the bees in dealing with this dead material suddenly placed in their hives. Some made little effort to do anything about it, while others tore down that portion of the comb entirely and removed it from the hive, later building new comb.

Of the twenty-five supposedly resistant colonies, seven were found to be entirely free from disease on September twenty-eighth. All six of the check colonies deteriorated rapidly and those which lived over winter were too far gone to survive long into the next summer. The others showed various degrees of susceptibility.

The seven which showed complete recovery, however, seemed to offer definite proof of the sought-for-resistance. The next step was to ascertain whether that quality is inherited.

On invitation of Dr. F. L. Thomas, state entomologist of Texas, four of these colonies were taken to the lower Rio Grande Valley in order to rear young queens for the next season's work. At the substation at Weslaco we were offered every facility for work and the assistance of S. W. Clark, entomologist there. This generosity made possible getting stock of the second generation in time for test during the season of 1936.

The young queens were taken to an isolated spot for mating, where they would meet drones also of resistant parentage. In early spring, colonies headed by these young queens were shipped to the experimental apiary in Iowa.

On June twenty-fifth the second generation bees to the number of twenty-seven colonies were given a test exactly like that of the year before and from the

same source, to insure uniform exposure. By the end of the season nine of these colonies were entirely free from disease.

This percentage of inheritance was thus much higher than had been expected, as one third of the bees showed marked resistance.

Thus, those who have claimed stock showing resistance to American foul brood have been vindicated, and we feel that it is definitely proved that there is an occasional colony having that quality. Of equal importance, it has been proved that the character may be inherited by succeeding generations.

There is an element of danger at this point. Beekeepers finding disease among their bees may rest easy, thinking that they may recover naturally. This is likely to be a mistaken idea, since none of the colonies which recovered from the dose which we gave would have shown any disease if left to themselves. We gave it to them deliberately. When the bee keeper does find disease among his bees it is very probable that it is because they are not resistant, and will never recover of themselves.

The problem of disease control is not yet solved. It remains to breed a strain of bees in which disease resistance is a dominant quality, and it is to be hoped that the stock thus brought to light may serve as a foundation for such an effort.

In the meantime beekeepers will do well to remain watchful for the appearance of disease and destroy it promptly until such time as disease-resistant stock becomes available.

## Whole Corn for Poultry

WHOLE corn is as good as cracked corn for laying hens. Cracking the corn causes a loss of some of the most valuable nutrients, so the uncracked corn is actually better than cracked corn for poultry. Why then does nearly everyone keep on feeding cracked corn? For the most part it is just habit.

Some hens won't eat whole corn. Just another case of habit. Give the hens a little time and they will learn to eat whole corn, and to prefer it to cracked corn. Mix in some whole corn with the scratch grain on range so that when you move the pullets into their winter quarters, you can entirely forget about cracked corn? You will save a dollar a ton on their feed and give them a better ration.—*L. E. Weaver, American Agriculturalist.*

# The Nature of Milk Fever

**Condensed from The Jersey Bulletin**

***J. Russell Greig, Ph.D., M.R.C.V.S.***

OF the numerous mysterious diseases that attack livestock, few have excited such interest or aroused such speculative controversy as milk fever in cows.

The dramatic suddenness of its onset in an animal that had had the appearance of perfect health; the severity of the attack which, untreated, results in a rapidly fatal termination; the specific efficacy of mammary inflation, were features of the disease as intriguing as they were baffling and inexplicable.

So many hypotheses have from time to time been formulated to explain its nature that milk fever has become known as the "Disease of Theories"; but it is only in recent years that experimental test has been applied to the problem.

The year 1897 marks an epoch in the history of milk fever. In that year, Schmidt, a veterinary practitioner in Kolding, Denmark, subjected the milk of affected cows to microscopic examination. He discovered what he believed to be evidence of cellular disintegration and concluded that some ferment or toxin within the udder was responsible for the decomposition of its lining epithelium.

In point of fact, Schmidt made a false observation, for what he mistook for degenerated cells were normal elements, and had he controlled his observations by examining the colostrum of healthy cows he would have found the same types of cells.

It was extraordinarily fortunate that he did not do so, for, having satisfied himself that the cause of the disease existed within the udder as a living virus, he immediately set himself to devise a means for its destruction.

With this object in view, Schmidt chose iodide of potassium, which was then believed to possess antiseptic properties, and he injected a solution of this drug into the udder in a series of cases of milk fever.

The Schmidt treatment met with remarkable success, and, on its becoming adopted, reduced the mortality from the disease from 60 or 70 per cent to 15 per cent. Later, upon the treatment being modified by Andersen and others, mammary inflation replaced the injection of fluids, and

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today the mortality is less than 1 per cent.

So it came about that upon a false observation, which in turn gave rise to a hastily formed and erroneous conclusion, there was discovered a therapeutic method the curative effects of which were as miraculous as its action was inexplicable.

But while a specific cure for the disease had been discovered, the cause of milk fever remained a mystery. Indeed, the very specificity of the cure rendered the nature of the malady all the more obscure.

In 1924 Professor Henry Dryerre of the Royal Veterinary College and the writer resolved to undertake the investigation of the problem, and as up to that time none of the experimental investigations had afforded any clue to the nature of the disease, we considered that a fruitful line of enquiry might be obtained by first submitting the whole problem to a process of reasoning. With this purpose in view, we collected all the available evidence bearing upon the disease in its occurrence and its clinical manifestations.

After critical examination of our data we arrived at certain tentative conclusions, and although these were unsupported by experimental evidence, we ventured to publish them in March, 1925, in the form of a working hypothesis, as they seemed to throw open an entirely new avenue by which the solution to the problem could be approached.

Commencing with the fact that specific cure resulted, no matter whether antiseptic fluids, sterile water, oxygen or air were injected into the udder, it seemed obvious that the effect, whatever it might be, depended upon the mechanical distension of the mammae.

We then premised that simple distension of the mammae must act either:

(1) by eliciting some endocrine disturbance, and/or

(2) by mechanically retarding or arresting milk secretion, and so preventing the loss in the milk of some substance vital to the organism.

That the disease was in some way closely associated with milk secretion was suggested by the facts that:

(1) Its appearance as a clinical entity was coincident with the commencement of the development of the modern heavy milking strains.

(2) It was much more prevalent in dairy breeds as distinct from beef breeds.

(3) It very commonly attacked those individuals which specially possessed deep milking qualities.

(4) The period of greatest susceptibility in the milking life of

an individual cow corresponded to the period of greatest milk secretion. Primiparae were very rarely affected.

(5) The rapid emptying of the udder by hand might precipitate the onset, while the practice of repeatedly removing small quantities of milk, or alternately, of permitting the calf to suck the cow for the first few days after calving, was recognized as a valuable preventive procedure.

The milk cow has been bred to produce an enormous quantity of milk; indeed, her milk secretion may now be regarded as almost pathological.

The colostrum of the cow is rich in calcium, and it was considered likely that the onset of a profuse lactation might occasion a rapid reduction in the concentration of the blood calcium. This idea seemed to be supported by our further observation that the spastic seizures which often characterise the early stages of milk fever were tetanic in character.

We believed that the mere mechanical withdrawal of calcium from the blood as the result of the onset of a profuse secretion of milk could not in itself be regarded as the cause of milk fever, because if this were so every heavy milking cow would be subject to the disease.

For that reason we postulated that some other factor, therefore, must act as a predisposing cause, and we suggested that such might be found in parathyroid dysfunction.

The following, then, were the essential points in our hypothesis:

(1) The nature of milk fever may be understood as a parathyroid deficiency, resulting in the accumulation of toxic substances, such as guanidine, and a fall in blood-calcium, the fall in calcium being further accentuated by lactation.

(2) The curative effect of mammary inflation is due to

(a) the stimulation of adrenal secretion and consequent oxidation of toxins, and/or

(b) the retardation of the formation of milk and the consequent prevention of further free exchange of calcium from the blood to the milk.

(3) The preventive value of a restricted withdrawal of milk from the udder after calving is due to this procedure conserving the concentration of calcium in the blood.

If our conception of the nature of the disease were correct, then it followed that the blood-calcium in milk fever should be below normal (hypocalcemia). Analyses of seven samples of blood from as many cases of milk fever showed an average of 4.8 mgm. calcium per cent serum: a marked reduction when compared with the normal—9 mgm. to 11 mgm. per cent.

While our subsequent work has amply confirmed our original view that acute calcium deficiency was an important factor in the production of the disease, there is now reason to doubt that the accumulation of guanidine bases plays an important part in its causation.

Our original view that mammary inflation possibly stimulated the secretion of adrenaline may also now be abandoned in view of the carefully conducted experiments of Auger, who was unable to note any rise in blood-pressure following inflation of the udder.

Later, in 1925, Little and Wright recorded the results obtained in blood-calcium determinations on twelve cases of milk fever. They showed that a considerable diminution in the blood-calcium (in mild cases 20 per cent to 30 per cent, and in severe cases up to 60 per cent) accompanied the onset of the disease, and they also found that the greater calcium reductions accorded with the more severe cases.

These and our own experiments therefore furnished considerable support to our hypothesis; but at this stage another and important theory attracted attention.

This new conception probably had its genesis as far back as 1923, when a Canadian veterinary surgeon, whose name is not recorded, observed that the comatose phase of milk fever bore a striking resemblance to the coma associated with the depletion of blood-glucose (hypoglycemia) which follows massive injections of insulin.

Support to this theory was supplied by several workers, notable Widmark and Carlens in Sweden, who showed that inflation of the udder in normal animals caused a rise in the sugar content of the blood, which reached its maximum in 1 to 1½ hours after inflation and then very rapidly diminished.

The theory of hypoglycemia on prima facie examination appeared very attractive, and it seemed that the matter could easily be verified or refuted by determinations of the blood-sugar content which obtained in the disease.

In seven cases of milk fever we found the figure for blood sugar to be high (0.081 per cent). This was in accordance with the published findings of other observers, all of whom have shown that a hyperglycemia and not a hypoglycemia was almost invariably present.

As is well known, sugar exists in the blood as glucose, and in this form it is, normally, readily available to the tissues. During lactation the blood-glucose is converted in the mammary gland

into lactose. Lactating animals frequently re-absorb lactose from the milk into the blood, and the high blood-sugar found in milk fever represents, according to Auger, a mixture of glucose and reabsorbed lactose.

Now lactose cannot be assimilated by the tissues, therefore it was assumed by Auger that although in milk fever there is admittedly an increase in the total sugar content of the blood, the actual available sugar (glucose) is deficient in amount.

At that time (1926) there was no technique known, whereby the two sugars could be differentiated in the blood, and Auger's assumption was difficult to meet; but if, as we suspected, glucose was actually present in excess in the blood, then some of this sugar should be excreted by the kidneys and appear in the urine, in which it could be identified.

We accordingly examined 14 samples of urine from as many cases of milk fever, and in 4 (about 28 per cent) of these glucose was obtained by the fermentation test, thus indicating the presence of excessive amounts of glucose, as distinct from lactose, in the blood.

Although these observations negatived the correctness of Auger's opinion, they need not be discussed at further length as the matter has been conclusively cleared up by Hayden and Fish. They, using the recently-devised Folin-Svedberg technique for the differentiation of sugars in the blood, showed definitely that in milk fever the great bulk of the sugar in the blood is glucose; indeed, the presence of lactose in the blood is of only occasional occurrence. Further, they showed that the increase in the blood sugar which follows mammary inflation is due very largely to lactose re-absorbed from the distended udder, and since lactose is useless to the tissues, its increase is without significance.

Still adhering to our belief that the essential nature of milk fever could be found in parathyroid failure, with resultant calcium deficiency and the consequent accumulation of toxic metabolites, we pursued our investigations, the summary results of which may be grouped in the following manner:

*1. Determination of Blood-Calcium Values in Parturient Cows*

Calcium is recognized as presenting less variation in quantity than any other constituent of the blood; in point of fact, the serum calcium content in a given individual is singularly constant.

The calcium content of a normal milch cow is generally accepted as varying from 9 mgm. to 11 mgm. per 100 c.c. serum, and we found that there is no difference between the calcium values in parturient cows as com-

pared with those in advanced lactation and with bullocks.

*2. Effect of Initial Lactation on Blood-Calcium Values*

The initial secretion of colostrum in the cow is accompanied by a transient but appreciable drop in the blood-calcium concentration, which returns to normal after the crisis of initiation of lactation is past.

*3. Determination of Blood-Calcium Values in Milk Fever*

Eighty-two samples of blood from as many cows attacked by milk fever have been examined. The calcium content in these cases ranges from a minimum of 3.00 mgm. per cent to a maximum of 7.76 mgm. The average of the values obtained in the cases works out at 5.13 mgm.

The significance of these figures is realised when they are compared with the blood-calcium content of normal parturient cows, the mean of 18 determinations being 9.90 mgm. per cent.

The degree of the severity of the symptoms bears a distinct relation to the calcium level in the blood. The fall in the calcium is so severe that it may be assumed that a general paralysing effect on all the tissue cells is consequently elicited. If this be so, the parathyroid will itself be involved and its proper activities arrested.

*4. The Blood-Calcium Concentration in Bovine Diseases other than Milk Fever*

That an acute hypocalcaemia is constantly associated with milk fever seemed to admit of no doubt, but that it might occur as a mere concomitant was an evident possibility. The author therefore considered it necessary to determine the calcium concentration in the blood of bovine animals suffering from diseases other than milk fever.

It was obviously desirable that the diseased conditions investigated should be widely representative in character, as it was the primary object of the enquiry to discover whether any diseased condition was accompanied by a hypocalcemia comparable to that which obtains in milk fever.

No condition of hypocalcemia at all comparable to that which obtains in milk fever was found to occur in any of the disease controls, which numbered 81 and covered a wide range of affections, including general febrile disturbances, pneumonia, pleurisy, post-parturient dyspepsia, pre-parturient paraplegia, tuberculosis, actinomycosis, Johne's disease, contagious abortion, acute digestive disturbances, septic infections, metritis, mastitis, uricaria, tetanus, cerebral coenurosis, painful locomotor affections and prostration following severe surgical operations.

A comparatively slight but notable hypocalcemia was observed to be associated with debilitating diseases, such as tuberculosis and Johne's disease, and also with some cases of acute digestive disturbance and recent abortions. The following comparative table summarises the findings:

*5. The Effect of Mammary Inflation on Normal Lactating Ewes*

Inflation of the mammae of normal lactating ewes cause a rise in the blood-calcium of about 10 per cent.

*6. Effect of Mammary Inflation on the Blood-Calcium in Milk Fever*

In a study of 15 cases of milk fever successfully treated by mammary inflation, it was found that this procedure invariably caused a rise in the blood-calcium value. The rise is at first rapid and is followed by a distinct hypercalcemia which may persist for several days. The cases usually show definite signs of recovery when a level of about 6 to 7 mgm. of calcium per cent has been reached.

It is probable that the curative effect of mammary inflation is a mechanical one in that it elicits mammary distension and so prevents the further interchange of calcium from the blood to the gland acini. There is also reason to believe that the calcium, which is heavily concentrated in the gland, is forced back into the blood as the result of the mammary distension. These may be at least tentatively accepted as plausible explanations. Schmidt's original treatment consisted in the injection of a small quantity of potassium iodide solution the volume of which was insufficient to distend the mammae. It is conceivable that the iodide of potassium itself arrested milk secretion and so prevented further calcium exchange.

*7. The Effect of Calcium Injections in the Treatment of Milk Fever*

In 1928, the writer, when seeking for a bland form of calcium which could be injected without producing local irritation, found that calcium gluconate produced little or no irritation even when injected subcutaneously. Mr. Stinson, of Appleby, then collaborated in a number of clinical tests, and the results obtained were highly encouraging.

In a series of over 100 cases of milk fever, the great majority have been rapidly and completely cured with a single injection of calcium gluconate. In only three cases the injection failed to produce a markedly beneficial response. In each of these cases there is reason to believe that either an inadequate dose was injected or that the time allowed

before mammary inflation was subsequently practised was insufficient.

It would therefore appear that a medicinal treatment of specific value has been found in the intravenous and subcutaneous injection of calcium gluconate.

*8. The Injection of Calcium as a Preventive of Milk Fever*

It has been found possible to abort a commencing attack of milk fever by flooding the blood with calcium upon the first appearance of the symptoms. It is calculated that the effect of a subcutaneous injection of calcium may be expected to last for about 20 hours. In a cow susceptible to the disease a subcutaneous injection of about 25 grm. of calcium gluconate immediately after calving and repeated in 20 to 24 hours may be found a valuable preventive treatment.

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**STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUG. 24, 1912, AND MARCH 3, 1933**
**of the Farmers Digest, published monthly at Ambler, Penna.**

State of Pennsylvania | ss
County of Montgomery |

Before me, a Notary Public in and for the State and County aforesaid, personally appeared L. Bush-Brown, who, having been duly sworn according to law, deposes and says that he is the Editor of the Farmers Digest and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit: 1. That the names and addresses of the publisher, editor and associate editors are: Publisher, The School of Horticulture, Ambler, Penna.; Editor, L. Bush-Brown, Ambler, Penna.; Associate Editors, C. Leavitt Dyer, New Hope, Penna.; R. L. Patrick, Philadelphia, Penna., and John A. Andrew, Ithaca, New York. 2. That the owner is L. Bush-Brown, Ambler, Penna. 3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: none. Signed, L. Bush-Brown, Editor. Sworn to and subscribed before me this 28th day of September, 1937 (Seal). J. A. Cassidy, Notary Public.

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